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The Effects of Gender and Regional Dialect on Performance in Aviation Communication

Erin E. McCollum

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THE EFFECTS OF GENDER AND REGIONAL DIALECT ON
PERFORMANCE IN AVIATION COMMUNICATION

by

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B.S., Florida State University, 2001

A Thesis Submitted to the
Department of Human Factors & Systems
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Human Factors & Systems

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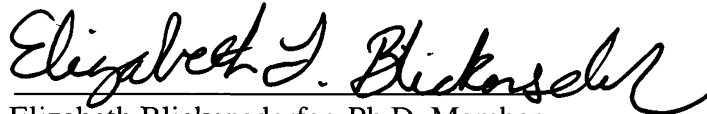
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This thesis was prepared under the direction of the candidate's thesis committee chair, Christina Frederick- Recascino, Ph.D., Department of Human Factors & Systems, and has been approved by the members of the thesis committee. It was submitted to the Department of Human Factors & Systems and has been accepted in partial fulfillment of the requirements for the degree of Master of Science in Human Factors & Systems.

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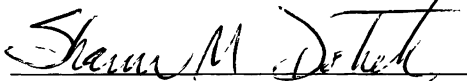
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ABSTRACT

The purpose of this study was to analyze the performance effects of gender and regional dialect on air traffic control statement recall. Sixty-one student volunteers participated in the experiment. Thirty-one participants held a pilot's license and 30 participants had no flight experience. Each participant listened to one CD with 60 ATC statements each representing a male and female voice and New England, Southern, and General American dialect. Participants were asked to recall exactly what they heard. If the participant could not understand what they heard, they requested a repeat. The participant's performance was recorded to CD and analyzed. Demographic questionnaires and dialect familiarity ratings were completed and analyzed.

Results showed that the best performance was with the male voice compared to the female voice. Results also showed that greater familiarity with a regional dialect will result in better performance when hearing that dialect. Although birth region was not found to have an impact on regional dialect comprehension, the regional dialect a person speaks in helps in comprehension among that dialect. Results also indicated that experience impacts dialect comprehension as the pilot group performed better across all variables than did the novice group.

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LIST OF ABBREVIATIONS

A	General American Dialect
ATC	Air Traffic Control
CD	Compact Disc
ICAO	International Civil Aviation Organization
FAA	Federal Aviation Administration
NE	New England Dialect
S	Southern Dialect
UN	United Nations
UTC	Coordinated Universal Time

INTRODUCTION

In day to day business situations, or in casual conversation, communication errors are seldom a threat to human life, but in aviation, the effects of miscommunication can be devastating (Cushing, 1995). Since communication between Air Traffic Control (ATC) and pilots take place without face to face contact, this eliminates the visual components of communication, such as body language and lip reading, on which many people rely in day to day communications. Air traffic controllers and pilots also form a unique speech community in the sense that they are “a group of people who routinely and frequently use a shared language to interact with each other” (Shames & Wigg, 1990). Within that unique speech community, miscommunication occurs on a regular basis. The more serious problems arise from the characteristics of language and from the way the mind processes what is heard (Cushing, 1995).

Humans possess multiple features that make us different from one another. Most of our features, however, come with a social stereotype. We group our fellow humans according to characteristics such as race, weight, age, attractiveness, and a multitude of other traits, including speech. Literature from the field of linguistics, for example, links differing stereotypes to various accents and languages (de Klerk & Bosch, 1995). In addition to articulatory differences, voice characteristics have also been allied with

specific personality traits (Blood, Mahan & Hyman, 1979). Another powerful stereotype in language is that of gender. There is significant literature explaining how men and woman differ in their speaking styles. For example, Lakoff (1975) argued that female speech is considered deviant, while male speech is taken as normal. It has also been suggested that women are very sensitive to linguistic norms because of their insecure social position (Trudgill, 1972). The traditional forms of female labor (housework and bringing up a family) lack status and prestige, so this must somehow be compensated for in other ways, one of which could be through use of more prestigious speech patterns. Men, on the other hand, are able to use nonstandard language norms because these possess the covert prestige associated with masculinity, mate ship, and working-class culture in general (Gordon, 1994).

Stereotypes can interfere with performance when individuals are perceived by themselves or others to lack prestige. Steele and Aronson (1995) show this by testing African American and White subjects completing a standardized test (the verbal portion of GRE) in one of two conditions. Condition one implied that the test was a test of intellectual ability, and condition two implied the test was a lab test unrelated to intellectual ability. African American subjects performed significantly worse when the task was labeled as an intelligence test versus not, while white subjects showed no difference in performance due to task labeling. As this study demonstrated social stereotypes can have adverse effects on individuals in education and employment realms as well as in day-to-day living (Eckberg, 2000). One way in which stereotypes are perceived is through the language one uses and the dialect of the speaker.

Statement of the Problem

There have been several recorded aircraft accidents within the last 30 years that show the importance of communication. Between 1976 and 2000, more than 1,100 passengers and crew lost their lives in accidents in which investigators determined that language was a contributing factor (Feminier, 2004). For example, in 1977, the Tenerife Air accident consisted of a Dutch pilot using Dutch syntax with English words and due to miscommunication resulted in 583 deaths. In 1989, an Azores flight had a communication error with the tower, resulting in 144 deaths. In 1999, in Kosovo, an Italian pilot of a UN flight could not understand the computer generated English warning and crashed, killing 24 people. A possible crash was averted in Chicago in 1999, when a Chinese Boeing 747 misunderstood taxi directions almost colliding with a Korean 747 taking off. On March 20, 2002 in Toulouse, France a pilot's routine report, "Fire on board," was interpreted as "Five on board" This left a feeling of possible hijackers on board and police surrounded all of the passengers until the miscommunication was resolved. In May 2003, in Turkey, an accident with a flight consisting of a Ukrainian pilot, Turkish ATC, and English words resulted in 75 deaths. Even within the English speaking United States, 22% of runway incursions are due to miscommunication. Because broken English cannot be found in the debris field of aircraft accidents, language confusion as a factor in aviation accidents has until now been ignored (Jones, 2003).

The purpose of the present study is to take the previous literature a step further to look at the effect different voice types, specifically gender and regional dialects have on performance in the aviation communication arena. The first radio equipped control tower in the United States opened at the Cleveland Municipal Airport in 1930. From that time

until the present, voice radio communications have played a primary role in air safety (Jones, 2003). There are currently 52 Open Skies agreements between the U.S. and other countries; every major airport in the world might receive airplanes from anywhere in the world. This fact necessitates a universal language for aviation, and since 1951 the language promoted by the International Civil Aviation Organization (ICAO) has been English. Conversation between pilots and controllers needs to be terse and clear, but English currently has 38 distinct dialects, and innumerable local accents (Encarta Dictionary, 1999). Today about 65% of aviation accidents and incidents are blamed on pilot error. A Boeing study concluded that from 1982 to 1991, 11% of crashes were due to miscommunication (Jones, 2003).

Review of the Literature

Regional Dialect

“A dialect is a variety of language spoken by a group of people who identify themselves with that particular way of speaking (Dept. of Translation Studies, 2003)”. Most dialects are regional, ethnic, or social subsets of a particular ‘national’ language. However, some ‘national languages’ might technically be considered to be dialects, and some ‘dialects’ have assumed the status of a ‘language’. A dialect is distinct from a language largely in the numerical, political or other influence of its speakers. Dialects can be viewed as varieties of a language that contrast in pronunciation, grammatical patterns, and vocabulary associated with a geographic region, as well as social class. Everyone speaks in dialect, and in fact, we all belong to many different social groupings, so our speech normally includes several layers of dialect. Most pronounced among the regional dialects in the United States are General American, Southern, and New England

(Wise, 1957). Today, dialectologists still focus primarily in three regions; however they are classified as Northern, Midland, and Southern. Local dialect is a subset of regional dialect, and may be specific to a particular city, such as New York, Pittsburgh, or Boston, or even to particular neighborhoods of a city, such as between Brooklyn and the Bronx in New York City, or Beacon Hill and the Back Bay in Boston. Although research definitions vary, accent more often refers to national variations and dialect refers to regional differences (Argyle, 1991; DeVito, 1986, Ellis & Beattie, 1986; Gill, 1991). Mobility and education may diminish the distinctiveness of a regional dialect, but can seldom completely eradicate it.

At the time of the inception of dialectology as a systematic study, scholars considered dialect differences to be mainly a function of region. Wholesale changes in mobility, urbanization, literacy, and other social factors have led to a drastic leveling of regional accents and dialects. Because of changing conditions, region is no longer the main determinant of dialect differences. With the rise of sociolinguistics in the last 35 years, dialectologists studying linguistic variation recognized the need to increase the number and kind of independent variables that are correlates of linguistic variation. Sociolinguists now look for linguistic correlates of class, sex, age, ethnicity, and other independent variables in urban settings (Chambers, 2000).

Phonology

The biggest differences in regional dialect are found in the phonology we hear (Dept. of Translation Studies, 2003). Different dialects select different phonemes for the lexical representation of particular words. Phonological knowledge permits a speaker to

produce sounds that have meaning, to make up words, and to absolve one's dialect. The phoneme is the shortest segment of speech that, if changed, changes the meaning of a word. Phonemes refer not to letters but to speech sounds. Because different languages use different sounds, the number of phonemes varies in languages. While there only 11 phonemes in Hawaiian, there are 48 in English, and as many as 60 in some African dialects (Goldstein, 1999). For example, the words fish and dish only differ in the first sound /f/ and /d/. Phonology within the African American English dialect deletes R use, so 'fort' would be pronounced 'fought' and 'court' pronounced 'caught'. Another major difference among dialects is morphology or syntax, which can be found when dialect influences differences in word and sentence structure (Carver, 1989). For example, syntax in African American English includes use of double negatives, deletion of the verb 'be' as well as habitual use of 'be'. A double negative would be "I ain't seen nobody" and deletion of the verb 'be' would be "he nice" as opposed to "he's nice". Habitual use of 'be' can also be used in the African American English dialect such as "he be late" as opposed to "he's late".

Factors used to depict differences in social dialects include linguistic variables, markers, and stereotypes. A linguistic variable is a linguistic item, which has identifiable variants (Butenuth & Schreiber, 2004). For example, words like singing and fishing are sometimes pronounced as *singin'* and *fishin'*. The final sound in these words may be called a linguistic variable. Markers are carriers of social information. People are aware of markers and the distribution of markers is clearly related to social groupings and to styles of speaking. For example, pronouncing *car* and *cart* in New York City in their r-less varieties marks one as using a type of pronunciation associated with lower-class

speech in that city. As in the focus of this paper, stereotypes are usually the most apparent differences within regional dialect. A few stereotypes associated with certain accents or dialects include the following; A Texan '*drawling*' or saying *Howdy Pardner*, the British use of *chap* or *mate* or the Bostonian use of '*Pahk the cah in the Hahvahd Yahd*' (Kurath, Hans & Raven, 1961).

Dialect Induced Judgments

The attention the listener pays to social dialect differences in running conversations is not well known. Studies of how people speak in different contexts and varying situations, and their judgments about the way other people speak can have an impact not only upon linguistic habits and changes, but also upon social pressures which affect speech habits (Harms, 1963). Most individuals tend to speak in the dialect from which they were raised, so when a person relocates to another environment he/she may feel social pressure in wanting to camouflage their dialect. Several conflicting theories have tried to explain differences in dialect – induced judgments.

Mulac and Rudd (1977) looked at the following stereotypes in order to analyze judgments of subjects who heard different voice types. The following stereotypes were analyzed by the subjects. 1) "us vs. them" (that members of a group rate their own dialect as being better than those using other dialects), 2) differential linguistic characteristics (that particular stylistic or phonological productions "sound" more dynamic, more pleasing), 3) extent of deviation from the general norm, and 4) stereotype reactions. In order to examine stereotype - based judgments this study was conducted using college graduates from three geographical regions: Southern California, Eastern Kentucky, and

Boston (Mulac & Rudd, 1977). Subjects from each of the three regions, both as transcript readers and audiotape listeners, were selected from among those people who spoke the regions predominate dialect. Speech transcripts were identified by number only; neither speaker region nor speaker sex was indicated. The investigation demonstrated that there exists a complex set of norms regarding speaker dialect within the United States. In general, data from this investigation measured listener rating stereotypes using three factors, 1) socio-intellectual status, 2) aesthetic quality, and 3) dynamism. For the socio-intellectual status factor, listeners' reactions to the phonological and prosodic aspects of the speech samples placed the General American speakers highest, Bostonians next, and Appalachians lowest. Aesthetic quality resulted in General American rating most pleasing, Appalachian next, and last the Bostonians. For the dynamism factor, Bostonian rated highest, General American next, and last Appalachian. One hypothesis, that members of a group give higher ratings to speakers employing their own dialect was not supported. For example, Eastern Kentucky listeners rated the Appalachian dialect speaker's phonological presentation lower in socio-intellectual status than the other two dialects. Also, all three groups of listeners preferred the General American speaker's aesthetic quality. The belief that linguistic characteristic differences in phonological and prosodic characteristics, such as rate, melody and stress may affect listener ratings was not significant in this study, however the study did produce interesting findings. The speakers judged by two regions as best on phonological dynamism, the Bostonians, did display the fastest rate of speech. The Appalachians who were placed lowest on dynamism by the other two regions' listeners were slowest in rate of speech. The third hypothesis, the extent of deviation from the

social norm was supported. The imposed norm hypothesis argues that one dialect has gained consensual validity over other varieties because of cultural norms. That is, greater degree of divergence from the general norm leads to lower ratings of linguistic styles outside the linguistic norm, leading to varying degrees of disadvantage when speaking in various parts of the United States. Stereotypes associated with particular dialects were verified in this study, as well as the literature. Lambert et al., (1960) and his associates have argued that a person's initial subjective reactions to linguistic characteristics are consistent with whatever stereotype he/she holds of that speaker's group.

A study by Markel, Eisler, and Reese (1967) investigated if judgments of personality could be made from dialect. Thirty-one female college students, all natives of Buffalo, evaluated the personality characteristics of 12 female speakers, six speaking with a New York City dialect and six with a Buffalo dialect. As hypothesized, there were significant differences between the ratings of the Buffalo and New York speakers with Buffalo speakers having the highest positive ratings of personality. The results lead to findings of previous research, and it was concluded that regional dialect is a significant factor in judging personality from voice. Although the results were significant, I think this study was biased in judging personality of Buffalo and New York City dialects using only Buffalo natives as the raters.

Regional dialect biases can go beyond affecting just social status; these biases may even affect job opportunities. A recent report from the University of North Texas found that the people who hire workers for many companies have an apparent bias against individuals with regional accents, especially applicants from the South and New Jersey. The method of this particular study used ratings of recorded voices of ten white

males from Texas, Georgia, Louisiana, Alabama, North Carolina, Minnesota, California, Boston, Chicago, and New Jersey. Participants were then questioned on their impressions of the speaker, including expected competency on the job. The speakers with the highest marks were from California, Minnesota, Boston, and Texas. Those rated worst were from Louisiana, Georgia, and New Jersey (Eckberg, 2000).

Gender Dialect Stereotypes

Just as regional dialect stereotypes exist, a speaker's gender has also been associated with stereotypes. Most of these stereotypes in the literature focus on communication styles. The general finding is that men are perceived to possess more instrumental attributes such as assertiveness, independence, and self-directing tendencies. The female stereotype has been associated with possessing expressive attributes, such as emotive qualities including, kindness, sensitivity, emotional responsiveness, and the need for affiliation (Rosenkrantz, Vogel, Bee, Broverman & Broverman, 1968). Despite upward trends in female employment and education, these gender-based stereotypes have persisted over time (e.g., Romer & Cherry, 1980; Ruble, 1983; Spence, Helmreich & Stapp, 1974). In discussing gender in this context, it is important to explain the difference between sex and gender. Sex is genetic and physiological, while gender is cultural and identity based (The American Heritage Dictionary, 2000). Hence, in biological sciences, sex differences are innate, chromosomally determined characteristics that distinguish between males and females, while in psychological and sociological sciences gender differences refer to male or female traits that result from learning and social roles.

Assumptions about how men and women use language have focused on anything from different syntactical, phonological or lexical uses of language to aspects of conversation analysis, such as topic and nomination control, interruptions and other interactional features (Pennycook, 2000). While some research has focused only on description of differences, other work has sought to show how linguistic differences both reflect and reproduce social difference. For example, Trudgill (1972) suggests that women are highly sensitive to linguistic norms because of their insecure social positions. Whether the stereotype is equally valid for all women is certainly debatable, but the fact of its existence, overt or subliminal, affects every one of us and its assumptions are generally agreed upon. Accordingly, Coates and Cameron (1988) suggests that research on language and gender can be divided into studies that focus on dominance and those that focus on difference.

Nass, Moon, and Green (in press) tested whether computers embedded with the most minimal gender cues evoked gender based stereotypic responses. This study presents an experimental demonstration of the power of gender stereotypes. In particular, three gender stereotypes were tested. The first stereotype examined was the belief that evaluation from males is more valid than evaluation from females. First, both men and women attend to male voices more intently than female voices (Robinson & McArthur, 1982); thus evaluative comments delivered by male voices should resonate more powerfully than the same comments delivered by female voices. Second, as agents of influence, men are regarded as more dominant and influential and as more effective leaders than women (Eagly & Wood, 1982). Although both instrumental and expressive traits are regarded as desirable to some degree in men and women, dominance and

aggressiveness are regarded as undesirable in women, but not in men (Costrich, Feinstein, Kidder, Marack, & Pascale, 1975). When males are placed in dominant roles, they tend to be perceived as being assertive or independent. When females are placed in dominant roles, they tend to be perceived as pushy or bossy. The third stereotype tested was that women know more about subjects that are regarded as “feminine”, whereas men know more about subjects regarded as “masculine”. Using a manipulation that effectively removed all other gender cues, including physical appearance and nonverbal communication, from the interaction, the authors provide evidence that vocal cues embedded in machines are sufficient to evoke gender based stereotypic responses. Results of the first stereotype (evaluation from males is more valid than evaluation from females) was confirmed as subjects rated the male voiced computer more positively with respect to friendliness and competence, than the female voiced computer. Results of the second stereotype (dominance in females is unbecoming) was also supported. Subjects evaluating the female voice computer rated the computer being significantly less attractive than subjects evaluating the male voiced condition. Results of the third stereotype (women know more about “feminine” topics, whereas men know more about “masculine” topics) was also consistent with the authors’ prediction. That is the male voiced computer was perceived as more informative about computers compared to the female voiced computer, whereas the female voiced computer was perceived as more informative about love and relationships compared to the male voiced computer (Nass, Moon, & Green, in press).

Gender Communication Styles

Much of the early literature in gender communication styles was focused on dominance. Lakoff's (1975) pioneering work suggested that women's speech typically displayed a range of features, such as tag questions, which marked it as inferior and weak. Thus, she argued that the type of subordinate speech learned by a young girl "will later be an excuse others use to keep her in a demeaning position, to refuse to treat her seriously as a human being" (Lakoff, 1975, p.5). There were however some problems with Lakoff's research as her analysis was not based on empirical research. Research has shown how men nominate topics more, interrupt more often, hold the floor for longer, and so on (Lakoff, 1975; Zimmerman & West, 1975). The chief focus of this approach has been to show how patterns of interaction between men and women reflect the dominant position of men in society.

Some studies have taken a different approach by looking not so much at power in mixed sex interactions as at how same sex groups produce certain types of interaction. In a study of this type, Maltz and Borker (1982) developed lists of what they described as men and women's features of language. They argued that these norms of interaction were acquired in same sex groups, and that the issue is therefore one of sub-cultural miscommunication, rather than social inequality. Much of this research has focused on comparisons between the "competitive" conversational style of men and the "cooperative" conversational styles of women. While some of the more popular literature in this field, such as Tannen's work (1987), lacks a critical dimension, the emphasis on difference has nevertheless been valuable in fostering research into gender

subgroup interactions and in emphasizing the need to see women's language use not only as "subordinate" but also as a significant subcultural domain.

Although Coates & Cameron's (1988) distinction on gender being divided between dominance and difference is a useful one, it also seems evident that these two approaches are by no means mutually exclusive. While it is important not to operate with a simplistic version of power and to consider language and gender only in mixed-group interactions, it is also important not to treat women's linguistic behavior as if it existed outside social relations of power. As Cameron, McAlinden and O'Leary (1988) ask, "Can it be coincidence that men are aggressive and hierarchically organized conversationalists, whereas women are expected to provide conversational support?" (Coates & Cameron, 1988).

Gender Dialect Induced Judgments

Although Lakoff's (1975) work in relation to gender speech being influenced and reinforced by social stereotypes had no empirical evidence, Newcombe & Arnkoff (1979) take her research a step further in their study, by researching the effect speech style and sex of speaker have on person perception.

The assumption that three of Lakoff's linguistic variables (tag questions, qualifiers, and compound requests) affect person perception was tested. Sex of speaker was also varied. A total of 80 subjects (40 male/ 40 female) were analyzed after listening to a tape of 48 short segments of conversation recorded by people simulating telephone conversation. After listening to each segment, subjects rated the speaker on their assertiveness, politeness, and warmth on a scale from one to ten. Results from this study

showed that tag questions were seen as less assertive than non-tag questions. Females have been associated with use of tag questions, because tags are open - ended questions that try to confirm truth, thus lacking speaker confidence. For example, a tag question would be “it’s cold in here, isn’t it?” Tags are also considered to be polite in that they allow the listener a graceful “out” in case of disagreement. There is also a greater female use of qualifiers, which are words or phrases such as “y’know”, “kinda”, “I guess”, or “maybe”, which dims definitiveness of an assertion, but are also polite in giving listeners an option of disagreeing or agreeing. Last, compound requests tend to have greater use in female speech, such as “won’t you close the door?” as opposed to simple requests like “close the door”. This is a way to politely request or statement action from the listener. All three “female” linguistic forms were rated less assertive than corresponding “male” forms; qualified speech and compound requests were rated warmer and compound requests more polite. These findings suggest that Lakoff’s intuitions concerning the effects of speech styles on person perception are largely correct and that modification of speech styles could allow men and women to influence how they are perceived by others (Newcombe & Arnkoff, 1979).

Sapir-Whorf Hypothesis

It is important to make reference to the Sapir-Whorf Hypothesis when researching various dialects in relation to stereotypes. The Sapir-Whorf hypothesis states that the structure of a language constrains thought in that particular language, and constrains and influences the culture that uses it (Brown, 1958). For example, if particular concepts are difficult to express in a language, the society and culture using the language will tend to

avoid them. The Sapir-Whorf hypothesis can be broken down into two basic principles: linguistic determinism and linguistic relativity. Linguistic determinism refers to the idea that the language we use to some extent determines the way in which we view and think about the world around us. Linguistic relativity states that distinctions encoded in one language are unique to that language alone, and that there is no limit to the structural diversity of languages (Black, 1962). his hypothesis has been controversial since first introduced in the 1950's, however in Freud's Ego and the Id he discusses the influence language has on thought (Freud, 1927). For example, the assertion that since genderless expressions in English language use 'masculine' forms such as 'congressman', 'mailman', 'gentlemen', etc.; English in fact would be considered sexist and the Sapir-Whorf hypothesis is presumed to be the truth. Based on the aforementioned literature about gender cues in language, it is evident there are not only language differences in gender, but also dominance and or social stereotypes that are deeply ingrained in human psychology, extending even to inanimate machines. The previous literature helps pave the way in order to study if these gender stereotypes we inherently learn will influence listener performance.

Speech Perception

There is a cognitive dimension to speech perception that depends on information stored in the listener's memory about the nature of language and about voice characteristics of specific speakers. Speech perception consists of top-down processing, which enables the listener to use his/her knowledge about the meaning of words or phrases, as opposed to just acoustical signals. This top-down processing also helps us to

recognize phonemes and words. Speech perception includes aspects of the speaker's voice, such as indexical characteristics (Goldstein, 1999). Indexical characteristics carry information about the speaker, such as age, gender, where he/she comes from, emotional states, and whether the person is being sarcastic or serious. Indexical characteristics are important, because they help aid recognition in the perceptual system. This was demonstrated by Palmeri, Goldinger & Pisoni (1993) who had subjects listen to a sequence of words. After each word, the subject indicated whether the word was a new word (this was the first time it appeared) or an old word (it has appeared previously in the sequence). They found that subjects reacted more rapidly and judged whether the word was new or old more accurately when the same speaker said all of the words, than if a new or different speaker said the words. It was concluded that listeners are taking in two levels of information about the word: it's meaning, as well as characteristics of the speaker's voice (Goldstein, 1999). Because there are two levels of information being processed, it makes sense in aviation that the speaker's voice should be as clear as possible to the listener in order to have a safe flight outcome.

Nygaard, Sommers, & Pisoni (1994) administered a test to determine how familiarity with a speaker's voice affects perception of spoken words. To accomplish this, two sets of listeners were trained to recognize the voices of 10 speakers over a 9 day period. At the end of the training period, the listener's recognition and perception of the speaker's words were evaluated to determine if he/she could identify the speaker's voice using phonetic analysis. It was found that the listeners acquired detailed knowledge about the speaker's voices that was not necessarily dependent on his/her words. Voice recognition and processing of the phonetic content of a linguist utterance are not

independently processed characteristics. Listeners who learned to recognize a set of speakers, apparently encoded and retained in long-term memory speaker-specific information that facilitated the subsequent perceptual analysis and identification of novel words produced by the same speaker. The implication of this is that phonetic perception and spoken word recognition appear to be affected by knowledge of specific information about a speaker's voice. If the same speaker spoke with various dialects and the listener was familiar with the speaker's voice characteristics comprehension may still be affected due to the phonetic content of the message, as different dialects use different phonetics.

Age

Studies have shown that speech perceptual skills are evident from a very young age and that within the first year of children's lives their speech perceptual capacities become attuned to the sound structure of the language they are exposed to; their mother's native tongue (Jusczyk, 1992). There are differences in the way children and adults perceive and analyze speech input; further development is necessary before adult-like speech perception is attained. Nittrouer (1996) has characterized this as a 'developmental weighting shift' where children assign different perceptual weights than do adults. Young children are able to acquire vocabulary at a fast rate via 'fast mapping': a word's meaning can be understood in part on first exposure and is later refined and restructured (Carey, 1978). Infants are able to acquire the accent of any language they are exposed to in a different way than adults because infants do not have any pre-existing lexical or phonological systems upon which to map the new data to.

A study by Nathan, Wells, & Donlan (1998) was administered in order to determine if age impacts single word comprehension when the accent of presentation is

not what the child is exposed to in his/her linguistic environment. Age - related developmental changes by which children process and interpret words of unfamiliar accents was also tested. Forty-eight children from London, age four and seven years old were tested on their ability to repeat and define single words presented in their own accent (London) and in a Glaswegian (Scotland) accent. Results showed that children found it harder to understand words spoken in an unfamiliar (Glaswegian) accent than in their own (London) accent. There were developmental differences in the extent of the childrens' difficulties with an unfamiliar accent: the seven year old children made significantly fewer errors overall than the four year old children. This indicates that making sense of unfamiliar accents is something that improves with age, at least between ages four to seven years. Although adults are able to process unfamiliar accents quicker than children, in safety critical domains such as aviation, any type of delay in reaction time can have a negative impact on flight safety.

A study (Mirenda, 1989) focused on synthetic and natural speech preferences of male and female listeners among various age groups was completed. The subjects consisted of five males and five females among each of four age groups (6-8 year olds, 10-12 year olds, adolescents, and adults). The listeners rated their preferences for eleven different voice types on a 5-point Likert scale, where four were natural voices and seven were synthetic voices. The preferences were of self and computer. Results showed that female listeners' preferred only natural female voices as acceptable to represent their own speech while rejecting the natural male voice and synthetic voices. Male listeners preferred female sounding voices to represent women and female children. Children

preferred to have computers produce synthesized speech, while adults preferred more natural sounding voices.

Speech Comprehension

Speech perception is related to word recognition based from memory where as comprehension relates to grasping or understanding. Speech perception and comprehension play a role in aviation communication. For example, a statement from controller to pilot must be comprehended by the pilot. There is minimal research to date in which types of dialects produce the clearest comprehension.

A study (Wilcox, 1978) was administered to college students enrolled at Nanyang University in Singapore in order to determine which accents students were able to comprehend the best. The students being tested had received twelve years of instruction in English, however they were still considered deficient in the language. Four male speakers represented speech samples using the following accents: General American English, British English, Australian English, and Singaporean-Malaysian English. After listening to each of the accents, students were given oral and multiple choice exams. The results indicated that average scores were highest in the Singaporean-Malaysian English accent and the second best accent was the British English. There was no significant difference in scores between the General English and Australian English accents. Therefore, it can be generalized that adults, in addition to young children will comprehend accents with which they are most familiar and most comfortable more accurately than those with which they are less familiar.

An experiment was administered at the Air Force Institute of Technology (Freedman, 1983) in order to determine the accuracy and speed of response to different voice types in a cockpit voice warning system. A total of 10 (4 male & 6 female) subjects were tested over a four day period and were instructed to press a designated button on a number pad. Warnings were interjected at random times in a male, female, and machine voice type. For the response to be counted as accurate, subjects had to push the correct button within three seconds. Results concluded that there is a significant difference in response to warnings given by different voice types. The male voice was associated with a greater accuracy than the female or machine voice. The machine voice was associated with the least accuracy and slowest speeds in reaction time.

The literature has shown that we can determine or assume social status, personality, and stereotype schemas of speaker from regional dialect alone. Because most humans associate specific stereotypes to the speakers and then elaborate on these beliefs when processing messages, this could ultimately lead to a problem in communication. In tasks, such as air traffic communication in aviation, speech based statements are used and comprehension of these statements is highly important in flight safety. The literature shows that people interpret speech using not only what is said, but also what is implied by formulated stereotypes of the speaker's dialect as well as the speaker's gender. The literature has also shown that people will make more errors judging non-familiar dialects than familiar ones. Therefore, it is hypothesized that performance in the processing of aviation control statement may be affected by regional dialect and gender differences.

Air Traffic Language Standards

Radio communications are a critical link in the air traffic control system.

The link can be a strong bond between pilot and controller or it can be broken with surprising speed and disastrous results. The International Civil Aviation Organization (ICAO) phonetic alphabet (See Table 1) is used by FAA personnel when communications conditions are such that information cannot be readily received without their use. Air traffic controllers may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency. Pilots are also instructed to use the phonetic alphabet in making initial contact with air traffic control facilities. Figures indicating hundreds and thousands in round numbers, as for ceiling heights and upper wind levels up to 9,900 should be spoken in accordance or the following: 500 five hundred, 4,500 four thousand five hundred. All other numbers should be transmitted by pronouncing each digit: 10 one zero. When a radio frequency contains a decimal point, the decimal point is spoken as “point”. In general, the commands given to the aircraft by ATC are very precise and can be easily categorized in a discrete set of functions, parameterized by real numbers indicating speed, heading, or other flight variables. A sample command given by ATC to an aircraft may be: “achieve flight level 290, turn to a heading of 130, reduce airspeed to 120 knots.”

Transmitting of altitudes and flight levels up to but not including 18,000 feet, state the separate digits of the thousands plus the hundreds. For example: 12,000 one two thousand or 12,500 one two thousand five hundred. The three digits of bearing, course, heading, or wind direction should always be magnetic. The word “true” must be added when it applies. For example: (Magnetic course) 005 zero zero five, (True course) 050

zero five zero true, (Magnetic bearing) 360 three six zero, (Magnetic heading) 100 heading on zero zero, (Wind direction) 220 wind two two zero. Speeds should be transmitted using separate digits and followed by the word “knots”. For example: (Speed) 250 two five zero knots, (Speed) 190 one nine zero knots. The FAA uses Coordinated Universal Time (UTC) for all operations. The word “local” or the time zone equivalent should be used to denote local when local time is given during radio and telephone communications. The term “Zulu” may be used to denote Coordinated Universal Time (UTC). For example: 0920 UTC zero nine two zero, zero one two zero pacific or local, or one twenty AM. (FAA, 2003).

All IFR pilots must file a flight plan at least 30 minutes before pushing back from the gate. The pilot reviews the weather along the intended route, maps the route and files the plan. The flight plan includes: flight number, aircraft type, the intended airspeed and cruising altitude, the route of the flight, centers that will be crossed and the destination airport. The pilot transmits the desired flight plan information to ATC, where it is then entered into the FAA main host computer. The computer generates a set of flight progress strips that are sent electronically from sector air traffic controller to sector air traffic controller across the flight plan. The flight progress strip contains all the necessary data for tracking the aircraft (Ye, 2003).

The directions that air traffic control gives to the pilot are classified as commands. A command is grammatically defined by the initial positioning of the verb (Knowsley, 2004). For example, a typical command from ATC would be “Hold for wake turbulence”. The verb is almost always at the beginning of the request, however many times the planes

identifier is stated prior to the command. An example of a planes identifier is Beechcraft one three one five niner.

Table 1. International Civil Aviation Organization (ICAO) phonetic alphabet

Character	Telephony
A	Alfa
B	Bravo
C	Charlie
D	Delta
E	Echo
F	Foxtrot
G	Golf
H	Hotel
I	India
J	Juliatt
K	Kilo
L	Lima
M	Mike
N	November
O	Oscar
P	Papa
Q	Quebec
R	Romeo
S	Sierra

T	Tango
U	Uniform
V	Victor
W	Whiskey
X	Xray
Y	Yankee
Z	Zulu
1	One
2	Two
3	Three
4	Four
5	Five
6	Six
7	Seven
8	Eight
9	Nine
0	Zero

Summary

Research has demonstrated that gender and regional dialect stereotypes exist within communication. Listeners tend to perceive male voices as assertive and direct and perceive female voices as sensitive and responsive. Lambert et al (1960) and his associates have argued that a person's initial subjective reactions to linguistic characteristics are consistent with whatever stereotype he/she holds of that speaker's group. Literature has shown that a male voice is associated with a faster reaction time when compared to a female or machine voice (Freedman, 1983). Minimal research has been completed on regional dialect or gender dialect in regards to comprehension, however it can be generalized that not only young children but adults will comprehend dialects with which they are most familiar and most comfortable more accurately than those with which they are less familiar (Wilcox, 1978).

Statement of the Hypothesis

Hypothesis: It is hypothesized that there will be an interaction effect based on participants' birth region and the regional dialect to which they are exposed. It is also hypothesized that there will be an interaction effect based on participant familiarity with the regional dialect and the dialect they are exposed to. It is also hypothesized that performance will increase with flight experience. It is also hypothesized that participant performance will decrease with a female speaker.

Hypothesis 1: It is hypothesized that there will be an interaction effect based on the participants' region of origin and the regional dialect to which they are exposed.

Specifically, participants will make less errors and need fewer repeats when hearing the same regional dialect of their predominate origin.

Hypothesis 2: It is hypothesized that there will be an interaction effect based on the researchers' evaluation of the regional dialect the participant speaks with and the regional dialect they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the same regional dialect in which they speak.

Hypothesis 3: It is hypothesized that there will be a negative correlation between the participant's self evaluated regional dialect familiarity and the regional dialect to which they are exposed. Specifically, participants will make fewer errors and need fewer repeats when hearing the regional dialect they are most familiar with.

Hypothesis 4: It is hypothesized that participant performance will increase with flight experience. Specifically, the pilot group will make fewer errors and request fewer repeats than the novice group.

Hypothesis 5: It is hypothesized that when a female voice is heard, performance will be decreased. Specifically, participants will ask for more repeats and make more errors when listening to a female voice.

METHOD

Participants and Design

Sixty one male, participants were recruited from the student population at Embry Riddle Aeronautical University to participate in this experiment. All sixty one participants were required to be United States citizens. Thirty one participants had a pilot's license with a class I and II medical clearance. The mean flight hours for the experienced group was 229 with the most experienced participant having 1940 flight hours and the least experienced pilot having 29 hours. Thirty participants did not have a pilots license or any experience in flight or air traffic control. The mean age for the sixty one participants was 21.9 years of age, the youngest participant being 18 and the oldest participant being 34 years old.

Materials

Dialect Compact Discs

A Califone stereo compact disc player with Koss TD61 headsets was used to play the sixty recorded air traffic control statements within a sound proof environment. Recall of these statements and "say again" requests were recorded by a microphone which was attached to each participant.

Each CD displayed the six various voice types of study with a total of sixty lines. Ten statements were given in a female New England dialect, ten in a female Southern dialect, and ten in a female, General American or newscaster's dialect. Ten statements were given in a male New England dialect, ten in a male Southern dialect, and ten in a male General American or newscaster's dialect. Each CD consisted of the same sixty statements and same speakers however they were scrambled six different ways in order to account for potential fatigue effects.

Two professional actors, one male and one female from Seaside Music Theater in Daytona Beach, FL were hired by the researcher to read the script of air traffic control statements. The male actor was recorded delivering ten ATC statements in a Southern dialect, ten in a New England dialect, and ten in a General American or newscaster's dialect. The female actor was recorded delivering ten ATC statements in a Southern dialect, ten in a New England dialect and ten in a General American dialect. Each script (See Appendix D) consisted of ten lines each with a total of sixty lines per CD. Each air traffic control statement was six words in length made up of numbers and letters. ATC statements were kept at a short length, therefore attempting to utilize only participants' short term memory.

Demographics

A demographic questionnaire (See Appendix B) was completed by each participant. This questionnaire helped in determining variables of focus including pilot experience and the region of participant birthplace as well as asking where participants lived most of their lives.

Dialect Familiarity

A dialect familiarity form (See Appendix D) was completed by each participant after the experiment concluded. A likert scale was used for participants to choose their familiarity level for a Southern, New England, and General American dialect. The options were “very much”, “somewhat”, “very little”, or “not at all”.

Design

A 4 x 3 x 2 mixed ANOVA was performed with participants’ birth region (West, Midwest, Northeast, or South) and regional dialect (New England, Southern, General American), and gender (male, female) of the speaker. The independent variables were participants’ birth region and regional dialect and gender of the speaker. The dependent variables were errors and repeats.

A 3 x 3 x 2 mixed ANOVA was performed with participants’ regional dialect rating (General American, New England, or Southern) and regional dialect (New England, Southern, General American), and gender (male, female) of the speaker. The independent variables were participants’ regional dialect rating and regional dialect and gender of the speaker. The dependent variables were errors and repeats.

A bi-variate correlation was performed with participants’ personal rating of their familiarity level for each regional dialect (New England, Southern, General American) and performance among each regional dialect (errors and repeats).

A 2 x 3 x 2 mixed ANOVA was performed with participants’ experience level (pilot or novice) and regional dialect (New England, Southern, General American), and

gender (male, female) of the speaker. The independent variables were participants' experience level and regional dialect and gender of the speaker. The dependent variables were errors and repeats.

Procedure

Upon arrival participants were asked to sign the consent form (See Appendix A) and complete the demographic questionnaire (See Appendix B).

Participants were then asked to sit at a desk in front of the laptop computer, approximately 13" from the monitor in the media studio on the Embry-Riddle Aeronautical University's campus. The door was closed and only the participant and experimenter were in the sound proof room. Instructions (See Appendix C) for the task were explained verbally as well as in print. The participant was given headphones to wear and a microphone was attached to their shirt for recording purposes. The participants were explained that they would be audio recorded.

Participants were instructed to keep their visual focus on the laptop computer as much as possible. The computer consisted of a slide show of over sixty different planes that were in the air as well as grounded. They were instructed they would hear sixty ATC statements and they should repeat word for word what they hear. If they did not understand the statement, they were asked to state "say again" or "repeat". They were then instructed they would not hear the same statement again however I needed to record if a "say again" was requested.

When the participants were ready to start they were told they would first hear four practice ATC statements to make sure they understood the directions and to adjust any

sound problems. After the practice CD ended, participants were encouraged to ask any questions and asked if they were ready to move on.

Once the participant was ready to move on, the CD of ATC dialects was started by the experimenter. The experimenter took note of which CD the participant was hearing for analysis purposes. After listening to the participants' recall of the ATC statements, the researcher took note of which regional dialect best represented the participants' voice type.

Upon completion of the CD, the participants were given the dialect familiarity (See Appendix D) form and asked to check the box they think is most appropriate for them. When the form was completed, the participant was debriefed and thanked for participating.

RESULTS

Descriptive Statistics

A total of 61 individuals participated in this experiment. All participants were male, Embry Riddle Aeronautical University students and were United States citizens. Thirty one of the participants held a private pilot's license and thirty of the participants did not have a pilot's license or any experience flying.

Data Analysis

Overall tables of group means and standard deviations are listed in the body of the text. Significant subsequent comparisons are listed in the body of the text.

The Effects of Birth Region on Performance

Hypothesis one stated there will be an interaction effect based on participants' birth region and the regional dialect they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the dialect of their birth region.

A three way mixed ANOVA design was used (birth region X speaker regional dialect X speaker gender) to analyze possible interaction effects among errors. The

independent variables were participants' birth region and regional dialect and gender of the speaker. The dependent variable was errors.

There were three potential main effects in this analysis. There was not a significant main effect found for birth region $F_{(3, 57)} = 1.99, p = .12$. There is approximately a 92% chance of finding a significant difference across the regional dialect means on errors. Partial eta squared showed that regional dialect accounts for 17% of the overall variance. There was a significant main effect found for regional dialect $F_{(1, 57)} = 11.65, p = .001$ (See Table 2, Figure 1).

Figure 1 shows that most errors were made when hearing the New England dialect and Southern dialect. The General American dialect resulted in the least errors. These differences were analyzed further with Tukey post hoc comparisons HSD (.05) = .39. Indeed, all comparisons were significantly different for the three regional dialects.

Table 2. Effect of Regional Dialect on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Regional Dialect	1	9.50	9.50	11.65	.001	0.92	.17
Error	57	46.46	.82				

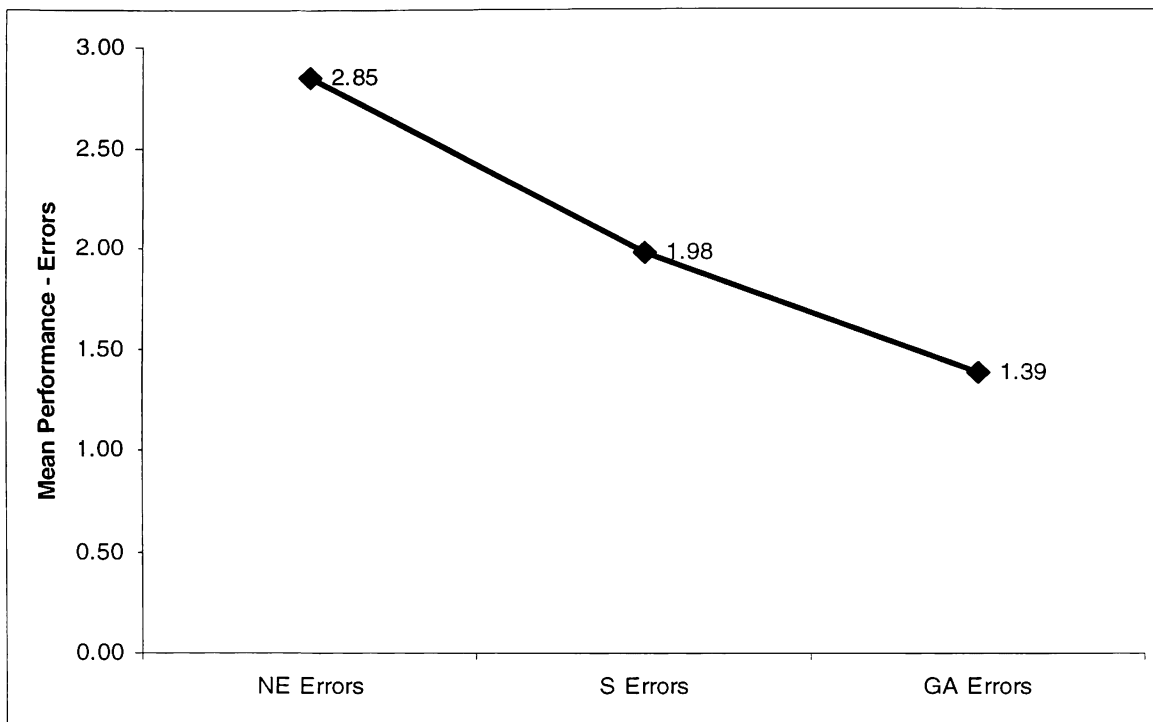


Figure 1. Effect of Regional Dialect on Errors

A significant main effect was found for gender $F_{(1, 57)} = 28.6, p = .00$ (See Table 3, Figure 2). Partial eta squared shows that 33% of the total variance is attributed to gender.

Figure 2 shows the mean performance when hearing a male voice and female voice. The female voice was associated with the most errors compared to the male voice. The power of this analysis was 100% for a significant difference between means for gender errors. These differences were analyzed further with Tukey post hoc comparisons $HSD (.05) = .36$. Indeed, there were significant differences in performance when hearing a male and female voice. Specifically, participants performed significantly different when hearing the New England male and New England female voice. Performance was also different when hearing a Southern male and Southern female voice.

Table 3. Effect of Gender on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	<i>n</i> ²
Gender	1	28.27	28.27	28.63	.00	1.0	.33
Error	57	56.28	.98				

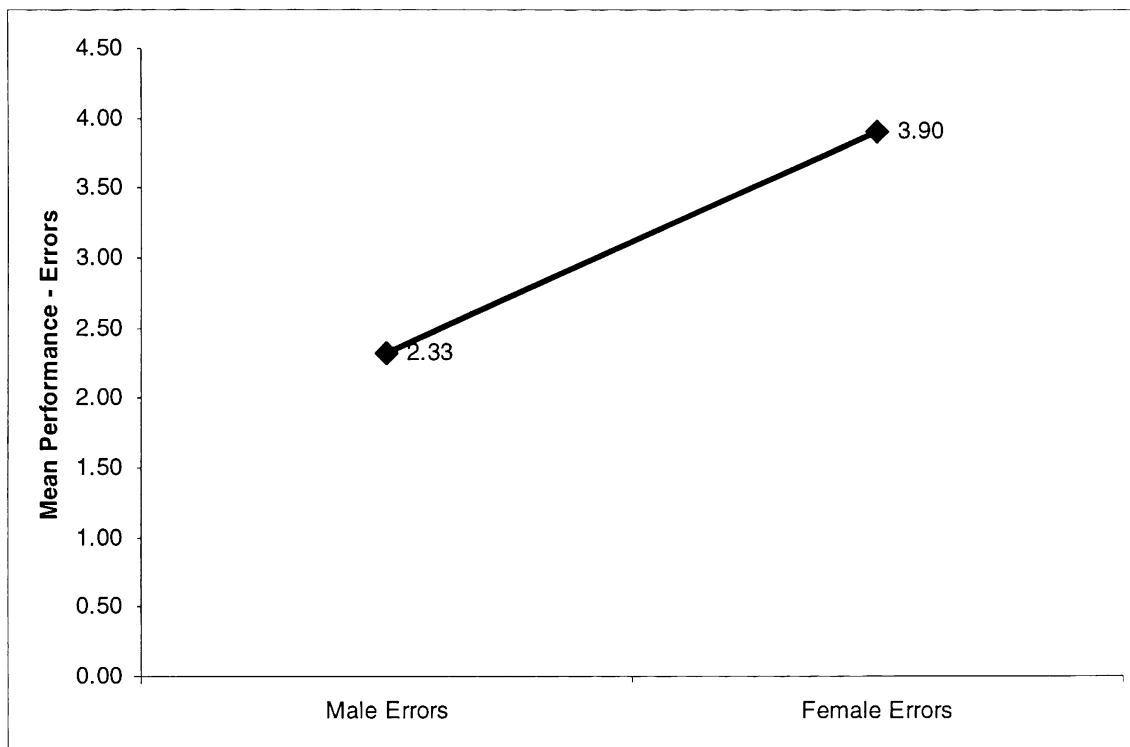


Figure 2. Effect of Gender on Errors

There were three potential two way interactions (birth region X speaker regional dialect, birth region X speaker gender, and speaker regional dialect X speaker gender) for errors. There was not a significant interaction for birth region and regional dialect $F_{(3, 57)} = 1.95, p > .05$. A significant interaction was found for birth region and gender $F_{(3, 57)} =$

3.45, $p = .02$ (See Table 4, Figure 3). The power of this analysis shows a 74% chance there is a significant difference across means for birth region and gender of speaker. Birth region and gender of speaker account for 15% of the total variance in this analysis.

Figure 3 shows that participants born in the Northeast did not perform significantly different when hearing the male and female voice types. Also, performance was better when hearing the male voice than when hearing the female voice regardless of the participants' birth region. These differences were analyzed further with Tukey post hoc comparisons $HSD (.05) = .53$. Indeed, there were significant differences between the participants' birth region and the gender of the speaker. Regardless of birth region, all participants performed differently when hearing the Southern male and Southern female voice. Participants from the West, performed differently among the General American male and General American female voice. They also performed differently among the New England male and New England female voice. Participants from the Midwest performed differently when hearing the New England male and New England female voice.

Table 4. Effects of Birth Region and Gender on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	<i>n</i> ²
Gender/Birth Region	3	10.20	3.40	3.45	.02	.74	.15
Error	57	56.28	.98				

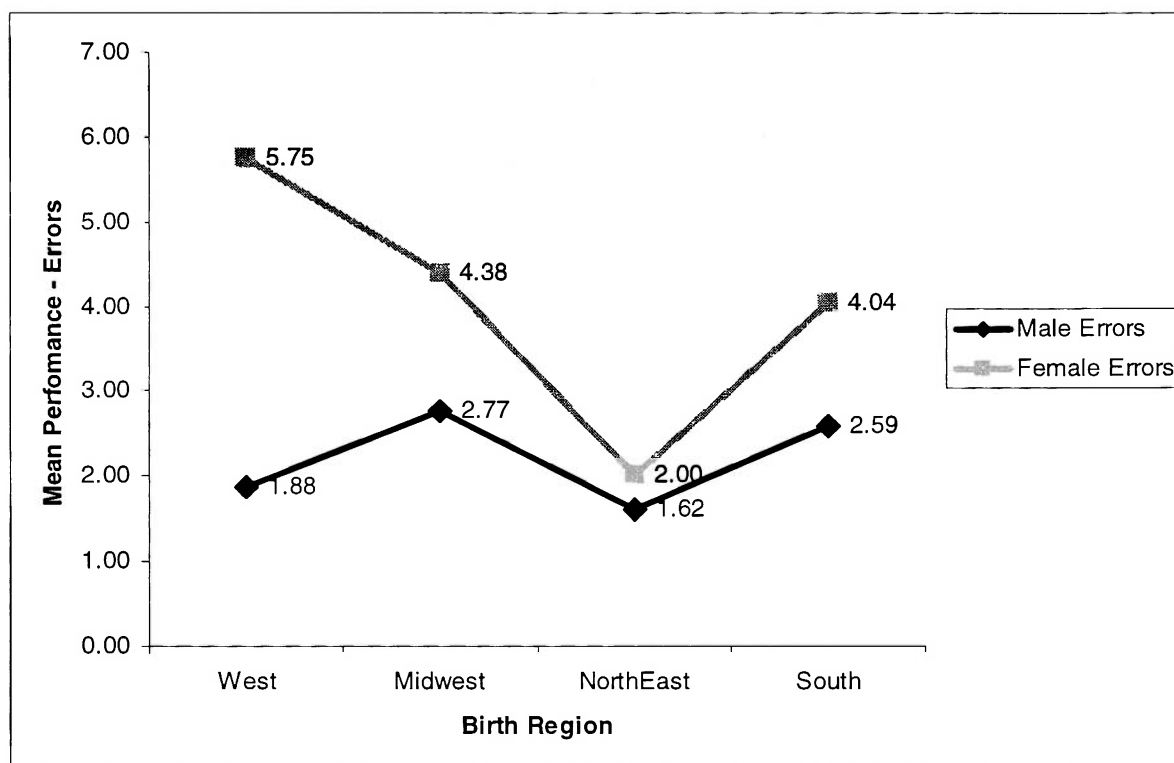


Figure 3. Effects of Birth Region and Gender on Errors

A significant interaction was found for regional dialect and gender of the speaker $F_{(1, 57)} = 4.24, p = .04$. (See Table 5, Figure 4). There is a 53% chance that there are significant mean differences for gender and regional dialect of the speaker. Partial eta squared shows that a mere 7% of overall variance can be accounted for by gender and regional dialect of the speaker.

Figure 4 shows performance among each regional dialect in relation to gender of the speaker. These differences were analyzed further with Tukey post hoc comparisons $HSD (.05) = .42$. Indeed, there were significant performance differences for regional dialect and gender of speaker. Performance was different among the New England male and New England female. Performance was also different among the Southern male and Southern female voice. Performance was different among the General American male and General American female for participants born in the West.

Table 5. Effects of Regional Dialect and Gender on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Gender/ Regional Dialect	1	2.94	2.94	4.24	.044	0.53	.07
Error	57	39.54	.69				

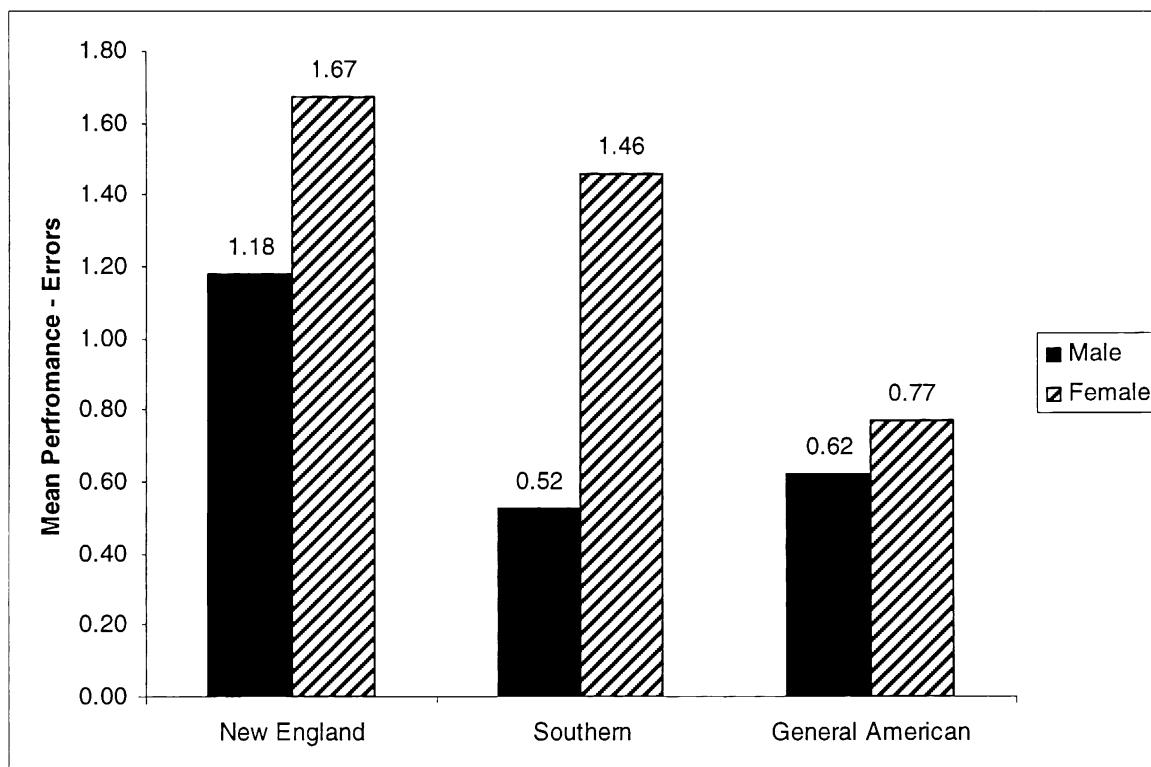


Figure 4. Effects of Regional Dialect and Gender on Errors

There was not a significant three way interaction for birth region, regional dialect and gender among errors $F_{(3, 57)} = .11, p > .05$. Hypothesis two was not completely supported among errors. Thus, participants' birth region and regional dialect and gender of speaker did not significantly influence performance.

Table 6. Birth Region Mean Differences on Errors

Source		Mean	SD	N
Voice Type	Birth Region			
NE Male	West	1.25	1.28	8
	Midwest	1.38	1.19	13
	Northeast	.62	.65	13
	South	1.33	1.14	27
	Total	1.18	1.10	61
GA Male	West	.25	.71	8
	Midwest	1.00	1.00	13
	Northeast	.54	.78	13
	South	.59	.80	27
	Total	.62	.84	61
S Male	West	.38	.74	8
	Midwest	.38	.65	13
	Northeast	.46	.88	13
	South	.67	.96	27
	Total	.52	.85	61
NE Female	West	2.13	1.13	8

	Midwest	2.08	1.44	13
	Northeast	.77	1.01	13
	South	1.79	1.31	27
	Total	1.67	1.33	61
GA Female	West	1.63	1.51	8
	Midwest	.85	1.21	13
	Northeast	.23	.60	13
	South	.74	.94	27
	Total	.77	1.10	61
S Female	West	2.00	1.51	8
	Midwest	1.46	1.20	13
	Northeast	1.00	1.41	13
	South	1.52	1.50	27
	Total	1.46	1.40	61

A three way mixed ANOVA design was used (birth region X speaker regional dialect X speaker gender) to analyze possible interaction effects among repeats. The independent variables were participants' birth region and regional dialect and gender of the speaker. The dependent variable was repeats.

There were three potential main effects in this analysis. There was not a significant main effect for birth region $F_{(3, 57)} = 1.91, p = .14$. There was a significant main effect for regional dialect $F_{(1, 57)} = 28.54, p = .00$ (See Table 7, Figure 5). There is approximately a 99% chance of finding a significant difference across the regional dialect means on repeats. Partial eta squared showed that regional dialect accounts for 33% of the overall variance.

Figure 5 shows that the most repeats were requested when hearing the New England dialect. The least amount of repeats were requested when hearing the General American dialect. These differences were analyzed further with Tukey post hoc comparisons $HSD (.05) = .21$. Indeed, performance was different among the New England and Southern dialects but not the General American dialect.

There was not a significant main effect for gender $F_{(1, 57)} = 1.83, p = .18$.

Table 7. Effect of Regional Dialect on Repeats

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	<i>n</i> ²
Regional Dialect	1	6.56	6.56	28.54	.00	.99	.33
Error	57	13.10	.23				

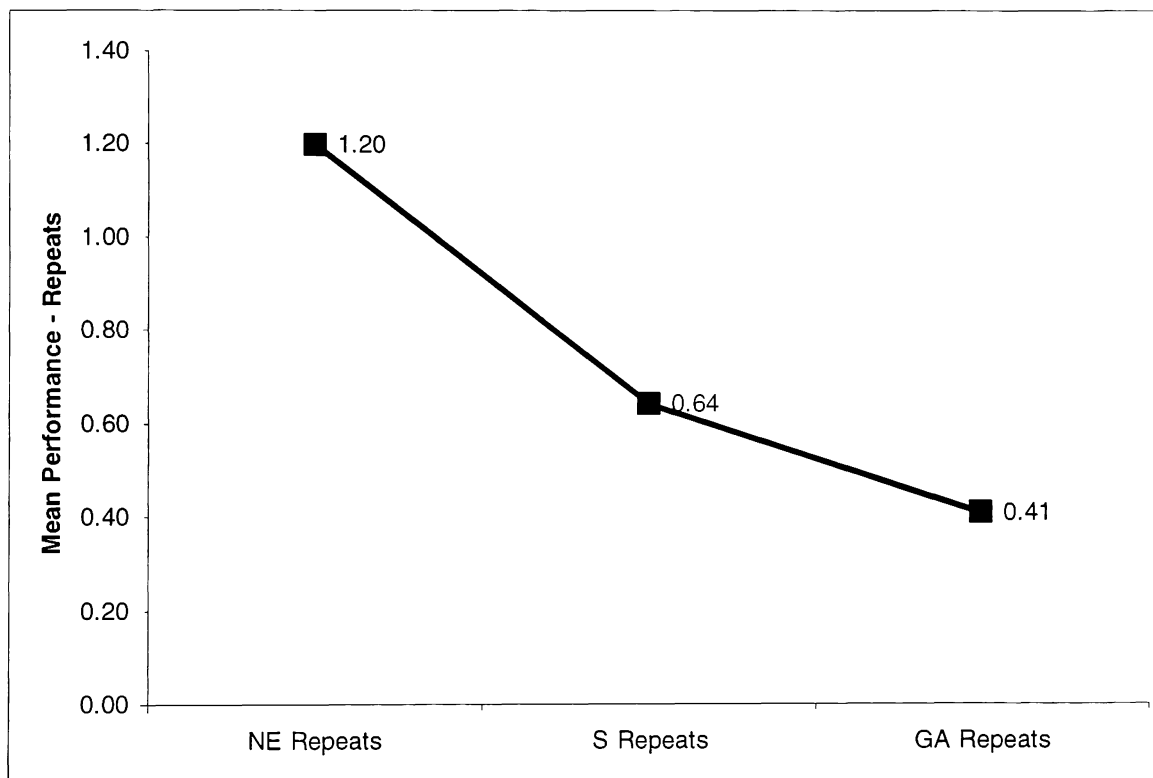


Figure 5. Effect of Regional Dialect on Repeats

There were three potential two way interactions (birth region X speaker regional dialect, birth region X speaker gender, and speaker regional dialect X speaker gender) for repeats. A significant interaction was found for participants' birth region and regional dialect of the speaker $F_{(3, 57)} = 3.82, p = .02$ (See Table 8, Figure 6). There is approximately a 79% chance of finding a significant difference among regional dialect repeats by birth region. Partial eta squared showed that regional dialect by birth region accounts for 17% of the overall variance.

Figure 6 shows mean performance for each regional dialect, grouped by birth region for repeats. The most repeats were requested when hearing the New England dialect, regardless of speaker gender (See Table 9). These results were analyzed further with Tukey post hoc comparison HSD $(.05) = .26$. Indeed, performance was significantly different between the participants' birth region and the regional dialect of the speaker. Those born in the West, performed significantly different between the New England and General American dialect as well as between the Southern and General American dialect. Participants from the Midwest, Northeast, and South did not perform significantly different between the regional dialects.

There was not a significant interaction for birth region and gender $F_{(3, 57)} = .31, p = .82$. There was not a significant interaction found for regional dialect and gender $F_{(1, 57)} = 3.25, p = .08$.

Table 8. Effects of Birth Region and Regional Dialect on Repeats

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	<i>n</i> ²
Birth Region/ Regional Dialect	3	2.63	.88	3.82	.02	.80	.17
Error	57	13.10	.23				

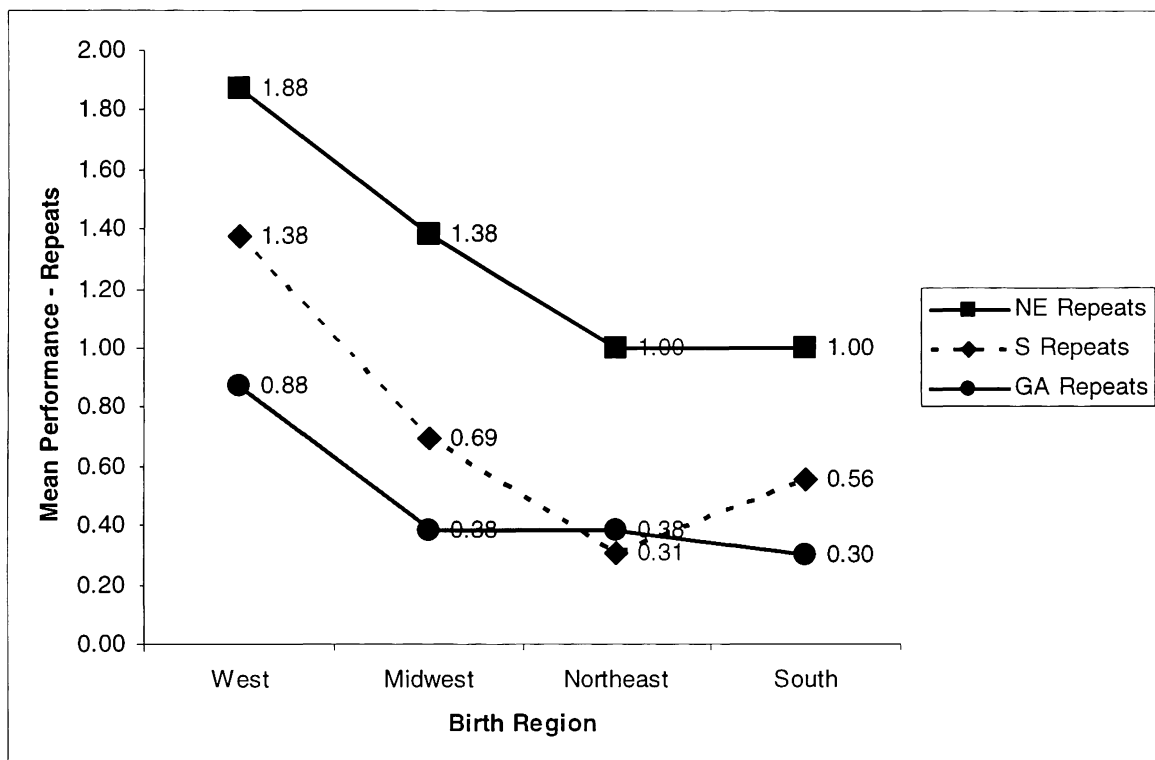


Figure 6. Effects of Birth Region and Regional Dialect on Repeats

There was not a significant three way interaction for birth region, regional dialect, and gender among repeats. As with the errors analysis, the majority of participants were born in the South and the fewest were born in the West. Participants born in the West and Midwest requested the most repeats among all regional dialects for both genders (See

Table 9). Hypothesis two was also not completely supported for repeats. Thus, birth region and regional dialect and gender of speaker did not significantly influence performance.

Table 9. Birth Region Mean Differences on Repeats

Source		Mean	SD	N
Voice Type	Birth Region			
NE Male	West	.13	.35	8
	Midwest	.31	.63	13
	Northeast	.15	.38	13
	South	.22	.51	27
	Total	.21	.49	61
GA Male	West	.50	.93	8
	Midwest	.08	.28	13
	Northeast	.23	.60	13
	South	.15	.46	27
	Total	.20	.54	61
S Male	West	.00	.00	8
	Midwest	.08	.28	13
	Northeast	.00	.00	13
	South	.04	.19	27
	Total	.03	.18	61
NE Female	West	1.75	1.28	8

	Midwest	1.08	.86	13
	Northeast	.85	1.14	13
	South	.78	.89	27
	Total	.98	1.03	61
GA Female	West	.38	.74	8
	Midwest	.31	.63	13
	Northeast	.15	.56	13
	South	.15	.36	27
	Total	.21	.52	61
S Female	West	1.38	1.69	8
	Midwest	.62	.77	13
	Northeast	.31	.63	13
	South	.52	.75	27
	Total	.61	.94	61

The Effects of Dialect Rating on Performance

Hypothesis two stated there will be an effect of participants' dialect rating and the dialect they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the dialect in which they speak.

A three way mixed ANOVA design was used (dialect rating X speaker regional dialect X speaker gender) to analyze possible interaction effects among errors. The independent variables were participants' dialect rating and regional dialect and gender of the speaker. The dependent variable was errors.

There were three potential main effects for this analysis. There was a significant main effect for dialect rating $F_{(2, 58)} = 3.54, p = .04$ (See Table 10, Figure 7). There is approximately a 64% chance of finding a significant difference across dialect rating means on errors. Partial eta squared showed that dialect rating accounts for 11% of the overall variance.

Figure 7 shows performance across all regional and gender dialects by dialect rating. Two participants were rated as speaking in a New England dialect, seven participants spoke with a Southern accent and the majority spoke with a General American dialect. Due to the inequality of the dialect ratings, analyses focused primarily on those rated as General American and those rated as New England and Southern were grouped as "other". These differences were analyzed further with Tukey post hoc comparisons $HSD (.05) = .41$. Group means in performance were significantly different enough to attribute to dialect rating.

There was not a significant main effect for regional dialect of speaker on errors $F_{(1, 58)} = 1.66, p = .20$. Also, there was not a significant main effect for gender of speaker on errors $F_{(1, 58)} = .91, p = .35$

Table 10. Effect of Dialect Rating on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Dialect Rating	2	22.80	11.40	3.54	.04	.64	.11
Error	58	186.99	3.22				

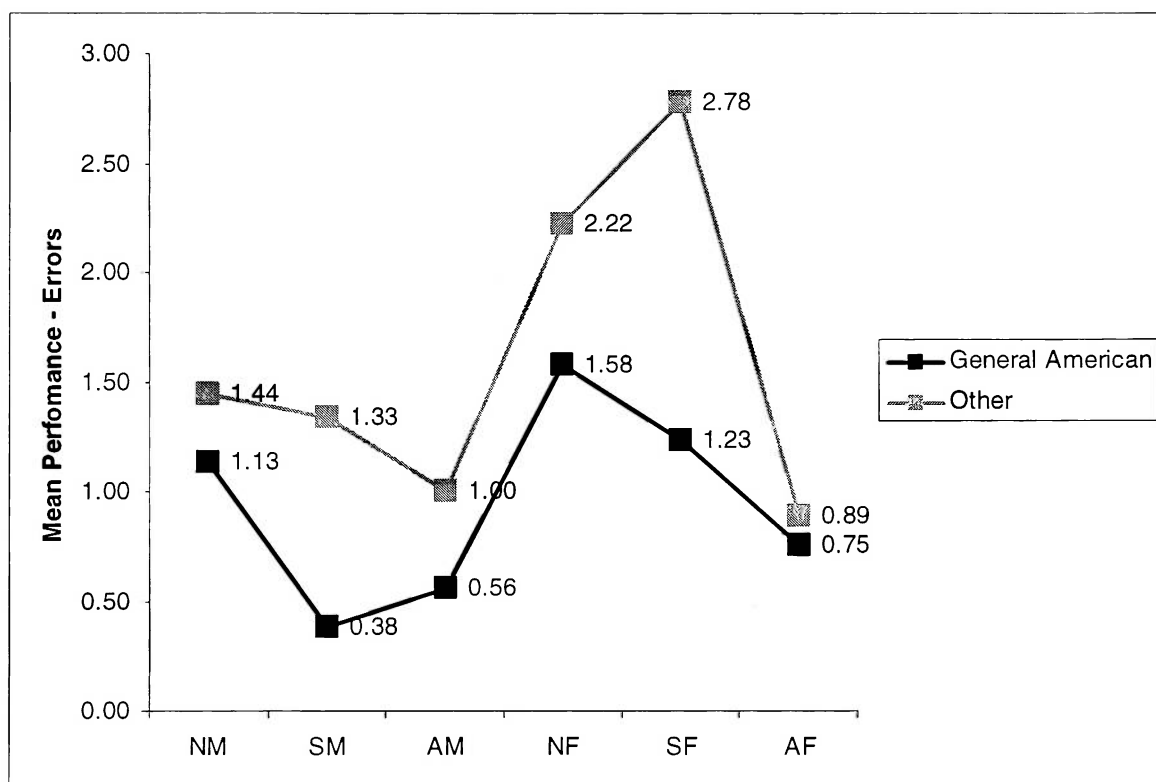


Figure 7. Effect of Dialect Rating on Errors

There were three potential two way interactions (dialect rating X speaker regional dialect, dialect rating X speaker gender, and speaker regional dialect X speaker gender) for errors. There was not a significant interaction for dialect rating and regional dialect $F_{(2, 58)} = .26, p = .78$. Also, there was not a significant interaction for dialect rating and gender $F_{(2, 58)} = .32, p = .73$. A significant interaction was found for regional dialect and gender $F_{(1, 58)} = 8.19, p = .01$ (See Table 11, Figure 8). There is approximately an 80% chance of finding a significant difference across regional and gender dialect means for errors. Partial eta squared showed that regional dialect and gender of speaker account for 12% of the overall variance.

Figure 8 shows the mean performance by regional dialect and gender of the speaker for errors. Although not hypothesized, the most errors were made when hearing the New England dialect, resulting in the worst performance. Regardless of regional dialect of the speaker, the most errors were made when hearing the female voice compared to the male voice. These results were analyzed further with Tukey post hoc comparison $HSD (.05) = .49$. Indeed, performance among the Southern dialect was significantly different between the male and female voice types regardless of participants' dialect rating. Also, those rated as "other" for dialect rating performed significantly different among all pair wise comparisons except for the General American and New England male. However, those rated as speaking in a General American dialect did perform differently when hearing a General American and New England male. Performance was also different between the New England and Southern male but was not different between the New England and Southern female for those rated as General American.

Table 11. Effects of Regional Dialect and Gender on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	<i>n</i> ²
Regional Dialect/ Gender	1	7.70	7.70	8.19	.01	.80	.12
Error	58	54.54	.94				

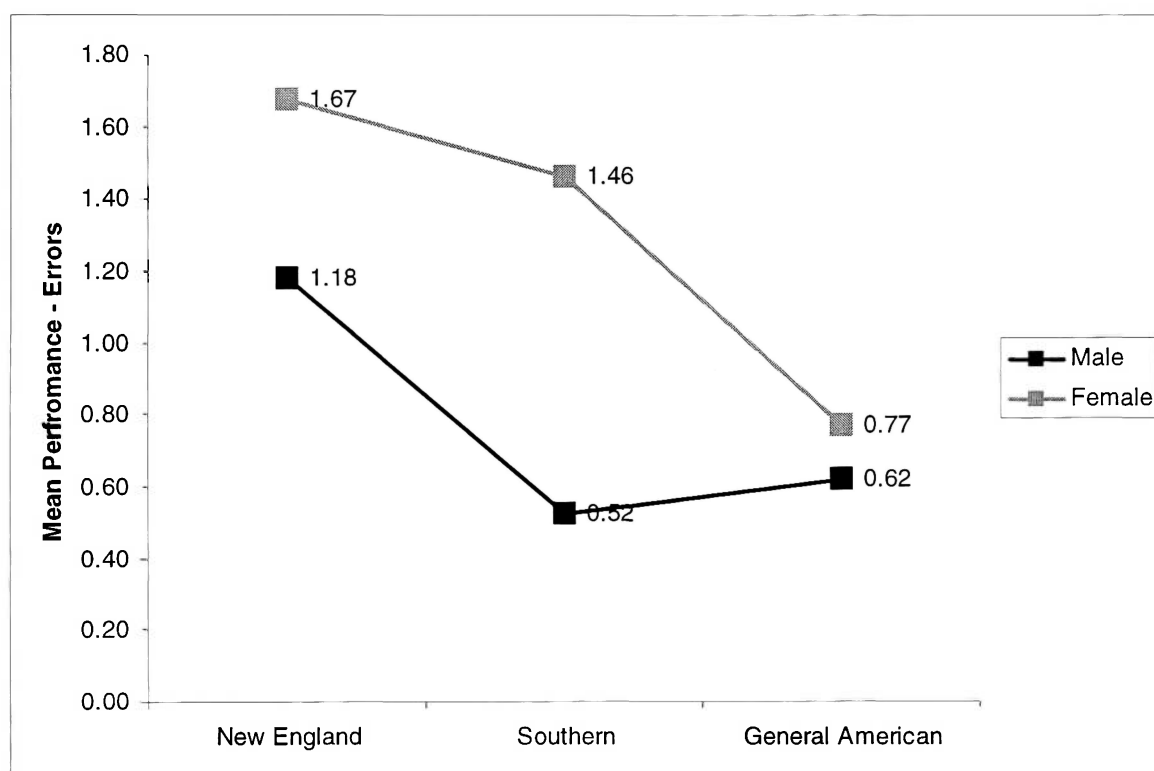


Figure 8. Effects of Regional Dialect and Gender on Errors

There was a significant three way interaction for dialect rating and regional dialect and gender of the speaker for errors $F_{(2, 58)} = 5.29, p = .01$ (See Table 12, Figure 9). There is approximately an 82% chance of finding a significant difference across regional dialect, gender and dialect rating for errors. Partial eta squared showed that regional dialect, gender and dialect rating account for 15% of the overall variance.

Figure 9 shows performance for each regional and gender dialect, grouped by participants' dialect rating. The first six bars refer to the male voice and the last six refer to the female voice. Note that the majority of participants were rated as speaking with a General American dialect. These results were analyzed further with Tukey post hoc comparison $HSD (.05) = .55$. Indeed, performance was different when hearing the Southern male and Southern female, regardless of participants' dialect rating. Those rated as General American also performed differently among the General American and New England dialects, regardless of speaker gender. Performance among the New England and Southern dialects was only different among the male speaker. Those rated as other performed significantly different among all pair wise comparisons other than the New England and General American male. (See Table 13).

Table 12. Effects of Regional Dialect and Gender and Dialect Rating on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Regional Dialect/ Gender/ Dialect Rating	2	9.94	4.97	5.29	.01	.82	.15
Error	58	54.54	.94				

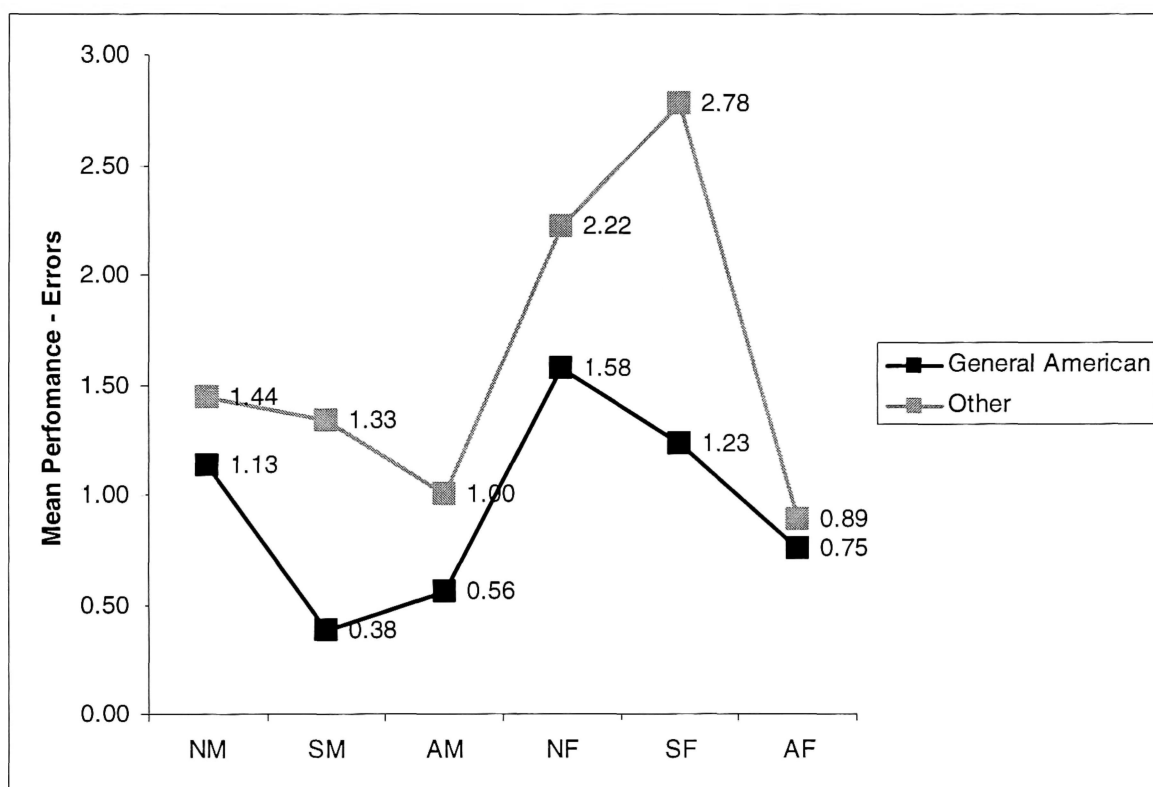


Figure 9. Effects of Regional Dialect and Gender and Dialect Rating on Errors

Hypothesis two was supported for errors. That is, there was a significant interaction effect for regional dialect and gender of the speaker and participants' dialect rating. Those rated as having a General American dialect made fewer errors, regardless of regional dialect or gender of the speaker compared to those rated with having a Southern or New England dialect.

Table 13. Dialect Rating Mean Differences for Errors

Source		Mean	SD	N
Voice Type	Dialect Rating			
NE Male	General American	1.13	1.10	52
	New England	.50	.71	2
	Southern	1.71	1.11	7
	Total	1.18	1.10	61
GA Male	General American	.56	.78	52
	New England	1.00	1.41	2
	Southern	1.00	1.16	7
	Total	.62	.84	61
S Male	General American	.38	.66	52
	New England	1.50	2.12	2

	Southern	1.29	1.25	7
	Total	.52	.85	61
NE Female	General American	1.58	1.32	52
	New England	2.00	1.14	2
	Southern	2.30	1.38	7
	Total	1.67	1.33	61
GA Female	General American	.75	1.08	52
	New England	.00	.00	2
	Southern	1.14	1.22	7
	Total	.77	1.09	61
S Female	General American	1.23	1.18	52
	New England	2.50	3.54	2
	Southern	2.86	1.57	7
	Total	1.46	1.40	61

A three way mixed ANOVA design was used (dialect rating X speaker regional dialect X speaker gender) to analyze possible interaction effects among repeats. The independent variables were dialect rating and regional dialect and gender of the speaker. The dependent variable was repeats.

There were three potential main effects for this analysis. There were no significant main effects for repeats. Specifically there was not a significant main effect for dialect rating $F_{(2, 58)} = .66, p = .52$. There was also not a significant main effect for regional dialect $F_{(1, 58)} = .68, p = .41$. There was also not a significant main effect for gender $F_{(1, 58)} = .06, p = .81$.

There were three potential two way interactions (dialect rating X speaker regional dialect, dialect rating X speaker gender, and speaker regional dialect X speaker gender) for repeats. There was not a significant interaction for dialect rating and regional dialect of speaker for repeats $F_{(2, 58)} = 1.15, p = .32$. There was not a significant interaction for dialect rating and gender of speaker for repeats $F_{(2, 58)} = 1.65, p = .20$. There was also not a significant interaction for regional dialect and gender of speaker for repeats $F_{(1, 58)} = .00, p = .99$.

There was potential for a three way interaction for dialect rating and regional dialect and gender of the speaker for repeats. There was not a significant three way interaction found for repeats $F_{(2, 58)} = .41, p = .66$. Hypothesis two was not supported among repeats (See Table 14).

Table 14. Dialect Rating Mean Differences for Repeats

Voice Type	Source	Mean	SD	N
	Dialect Rating			
NE Male	General American	.17	.043	52
	New England	.50	.71	2
	Southern	.43	.79	7
	Total	.21	.49	61
GA Male	General American	.15	.50	52
	New England	.00	.00	2
	Southern	.57	.79	7
	Total	.20	.54	61
S Male	General American	.02	.14	52
	New England	.00	.00	2
	Southern	.14	.38	7
	Total	.03	.18	61
NE Female	General American	1.02	1.02	52
	New England	.50	.71	2
	Southern	.86	1.22	7

	Total	.98	1.03	61
GA Female	General American	.21	.54	52
	New England	.00	.00	2
	Southern	.29	.49	7
	Total	.21	.52	61
S Female	General American	.60	.93	52
	New England	.00	.00	2
	Southern	.86	1.07	7
	Total	.61	.94	61

The Effects of Dialect Familiarity on Performance

Hypothesis three stated that there will be a negative correlation between participants' self rated regional dialect familiarity and the regional dialect which they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the regional dialect they are most familiar with.

A bi-variate correlation was completed in SPSS® to assess possible correlations with participants' familiarity rating for each regional dialect (New England, Southern, General American) with performance (errors and repeats) for each regional dialect. Gender of speaker was collapsed in this analysis. Results for the significant correlations are listed in Table 17. The analysis did support this hypothesis partially. New England dialect familiarity and New England dialect errors resulted in a significant negative correlation $-.303$. There was also a significant negative correlation for New England dialect familiarity and General American dialect errors, $.262$. The strongest negative correlation was for Southern dialect familiarity and New England dialect repeats, $.322$. Therefore as familiarity with the New England dialect increased, errors decreased when hearing the New England and General American dialect. As Southern dialect familiarity increased, repeats needed in hearing the New England dialect decreased. The other combination of variables was not statistically significant, therefore hypothesis four was not completely supported (See Table 15).

Table 15. Correlations of Dialect Familiarity and Performance

Familiarity	New England Errors	Southern Errors	General American Errors	New England Repeats	Southern Repeats	General American Repeats
Participants $n = 61$						
New England	*-.303	.215	*-.262	-.077	-.068	-.192
Southern	.117	-.033	.168	**-.322	-.162	-.166
General American	.180	-.046	.226	.007	-.153	-.034

* Indicates significant relationship at the .05 alpha level.

** Indicates significant relationship at the .01 alpha level.

The Effects of Experience on Performance

Hypothesis four stated that performance will increase with flight experience. Specifically, the pilot group will make fewer errors and need fewer repeats compared to the novice group.

A three way mixed ANOVA design was used (experience X speaker regional dialect X speaker gender) to analyze possible interaction effects among errors. The independent variables were experience and regional dialect and gender of the speaker. The dependent variable was errors.

There were three potential main effects in this analysis. There was a significant main effect found for experience $F_{(1, 59)} = 7.35, p = .01$ (See Table 16, Figure 10). There is approximately a 76% chance of finding a significant difference across experience level

for errors. Partial eta squared showed that experience alone accounts for 11% of the overall variance.

Figure 10 shows the mean performance per regional dialect by experience level. The pilot group performed better than the novice group across all three regional dialects. These results were analyzed further with Tukey post hoc comparison HSD ($.05$) = .64. The post hoc test concluded that performance was significantly different between the Southern male and Southern female voice, regardless of participants' experience level. Also, regardless of participants' experience level, performance was different between the New England female and General American female voice. Performance was also different between the General American female and Southern female. Performance was not different between the regional dialects spoken in a male voice.

Table 16. Effect of Experience on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Experience	1	23.25	23.25	7.35	.01	.76	.11
Error	59	186.55	3.16				

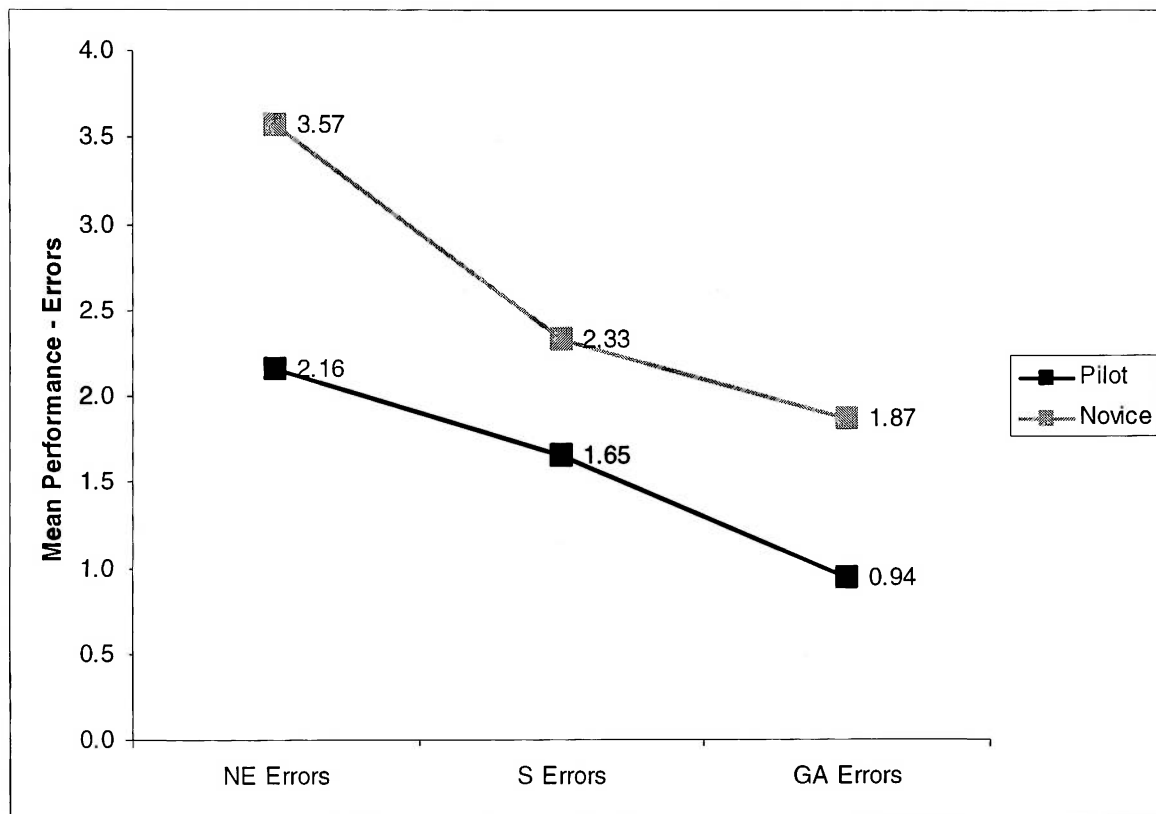


Figure 10. Effect of Experience on Errors

There was a significant main effect found for regional dialect $F_{(1, 59)} = 4.90, p = .03$ (See Table 17, Figure 11). There is approximately a 59% chance of finding a significant difference across regional dialect for errors. Partial eta squared showed that regional dialects accounts for 8% of the overall variance.

Figure 11 shows the mean errors for each regional dialect. The most errors were made when hearing the New England dialect. These results were analyzed further with Tukey post hoc comparison HSD (.05) = .90. The post hoc test concluded that performance was significantly different across all three regional dialects. That is, regardless of gender of the speaker or participant experience, performance was significantly different between the Southern and New England dialect, the Southern and General American dialect, and the New England and General American dialect.

There was not a significant main effect for gender $F_{(1, 59)} = 1.37, p = .25$.

Table 17. Effect of Regional Dialect on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Regional Dialect	1	4.23	4.23	4.90	.03	.59	.08
Error	59	51.01	.86				

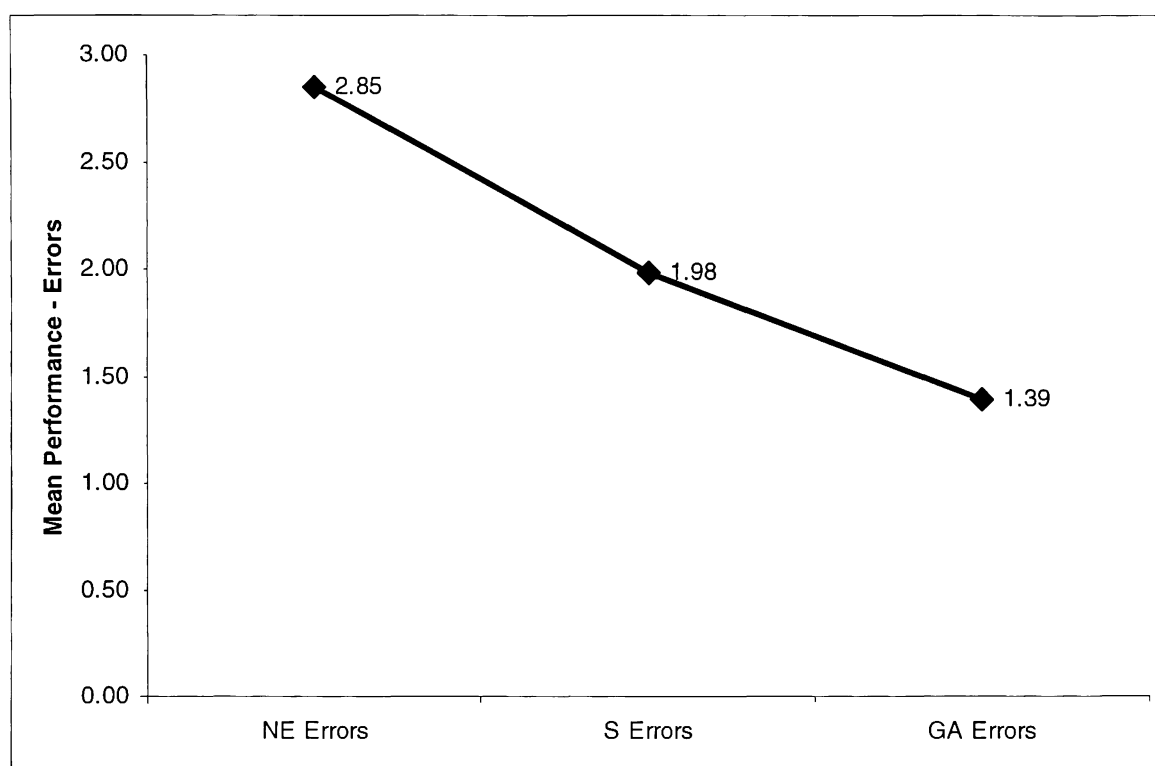


Figure 11. Effect of Regional Dialect on Errors

There were three potential two way interactions (experience X speaker regional dialect, experience X speaker gender, and speaker regional dialect X speaker gender) for errors. There was not a significant interaction for experience and regional dialect of speaker $F_{(1, 59)} = .35, p = .56$. Also, there was not a significant interaction for experience and gender of speaker $F_{(1, 59)} = 1.09, p = .30$. There was not a significant interaction for regional dialect and gender of speaker $F_{(1, 59)} = .01, p = .92$.

There was also potential for a three way interaction for experience and regional dialect and gender of the speaker for errors. There was not a significant three way interaction found for errors $F_{(1, 59)} = 1.24, p = .27$.

There were no significant interactions found for hypothesis four. The pilot group did in fact perform the best compared to the novice group, regardless of the regional dialect and gender of the speaker. Although not hypothesized, both groups made the most errors when hearing the New England and Southern dialect with the female voice (See Table 18).

Table 18. Experience Mean Differences for Errors

Source		Mean	SD	N
Voice Type	Experience			
NE Male	Pilot	.81	.79	31
	Novice	1.57	1.25	30
	Total	1.18	1.10	61
S Male	Pilot	.48	.81	31
	Novice	.57	.90	30
	Total	.52	.85	61
GA Male	Pilot	.42	.77	31
	Novice	.83	.87	30
	Total	.62	.84	61
NE Female	Pilot	1.35	1.40	31
	Novice	2.00	1.17	30
	Total	1.67	1.33	61
S Female	Pilot	1.16	1.24	31
	Novice	1.77	1.50	30
	Total	1.46	1.40	61
GA Female	Pilot	.52	.81	31

Novice	1.03	1.27	30
Total	.77	1.09	61

A three way mixed ANOVA design was used (experience X speaker regional dialect X speaker gender) to analyze possible interactions among repeats. The independent variables were flight experience and regional dialect and gender of the speaker. The dependent variable was repeats.

There were three potential main effects in this analysis. There was not a significant main effect found for experience $F_{(1, 59)} = 2.76, p = .10$. There was a significant main effect found for regional dialect $F_{(1, 59)} = 20.81, p = .00$ (See Table 19, Figure 12). There is approximately a 99% chance of finding a significant difference across the regional dialects for repeats. Partial eta squared showed that regional dialect alone accounts for 26% of the overall variance. There was not a significant main effect for gender $F_{(1, 59)} = 1.78, p = .19$.

Figure 12 shows the mean performance for each regional dialect for repeats. The most repeats were requested when hearing the New England dialect and the fewest were needed when hearing the General American dialect. These results were analyzed further with Tukey post hoc comparison $HSD (.05) = .22$. The post hoc test concluded that performance was significantly different between New England male and New England female, regardless of experience level. Also, performance was different between the Southern male and Southern female, regardless of experience level. The pilot group performed differently between all regional dialects spoken in a female voice. Performance was only different between the New England and General American dialects spoken in a male voice. The novice group performed different among the New

England and Southern male voice as well as the General American and Southern male voice. The novice group also performed differently in all regional dialects spoken with a female voice except for the New England and Southern dialects.

Table 19. Effect of Regional Dialect on Repeats

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Regional Dialect	1	5.10	5.10	20.81	.00	.99	.26
Error	59	14.46	.25				

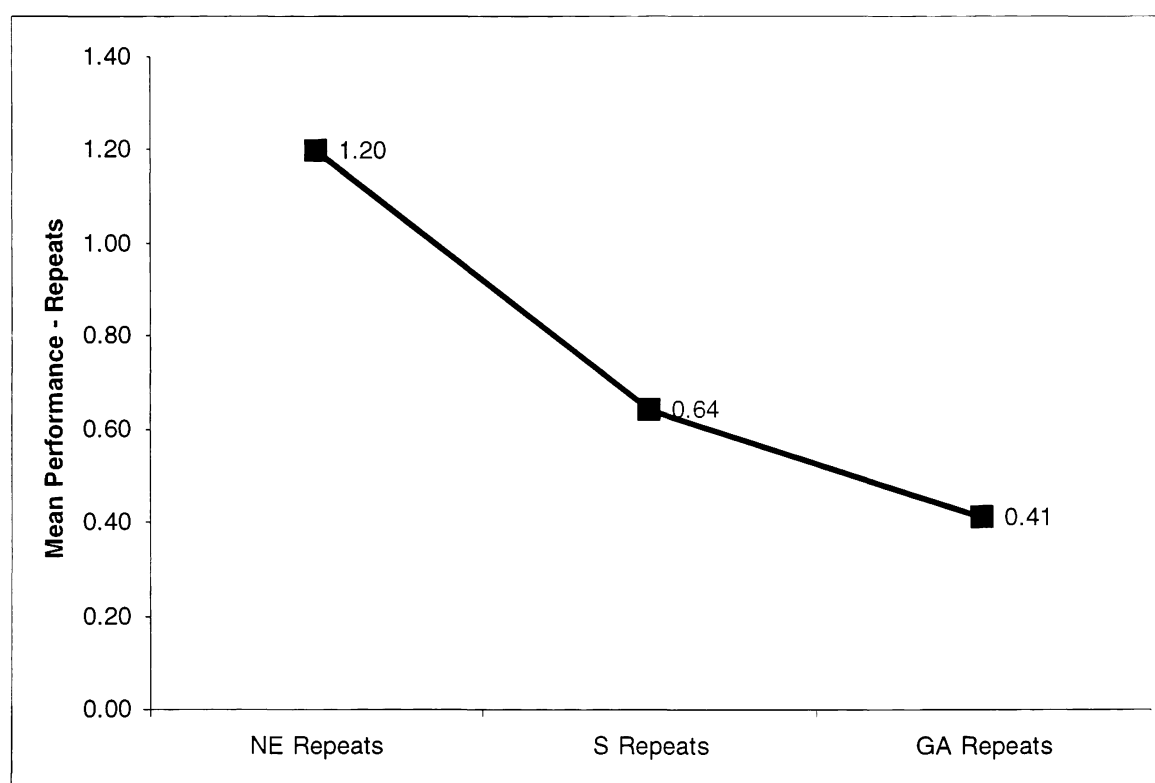


Figure 12. Effect of Regional Dialect on Repeats

There were three potential two way interactions (experience X speaker regional dialect, experience X speaker gender, and speaker regional dialect X speaker gender) for repeats. A significant interaction was found for experience and regional dialect $F_{(1, 59)} = 5.17, p = .03$ (See Table 20, Figure 13). There is approximately a 61% chance of finding a significant difference between experience levels for the regional dialects on repeats. Partial eta squared showed that experience and regional dialect account for 8% of the overall variance.

Figure 13 shows the mean performance for each level of experience across all regional dialects. The novice group requested more repeats compared to the pilot group for each regional dialect heard. Both groups needed more repeats when hearing the New England dialect and needed the fewest repeats when hearing the General American dialect. These results were analyzed further with Tukey post hoc comparison HSD (.05) = .02. The post hoc test concluded that performance was significantly different among all possible pair wise comparisons. That is, the pilot group performed differently among all three regional dialects. The novice group also performed differently among all three regional dialects.

Table 20. Effects of Experience and Regional Dialect on Repeats

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	<i>n</i> ²
Experience/ Regional Dialect	1	1.27	1.27	5.17	.03	.61	.08
Error	59	14.46	.25				

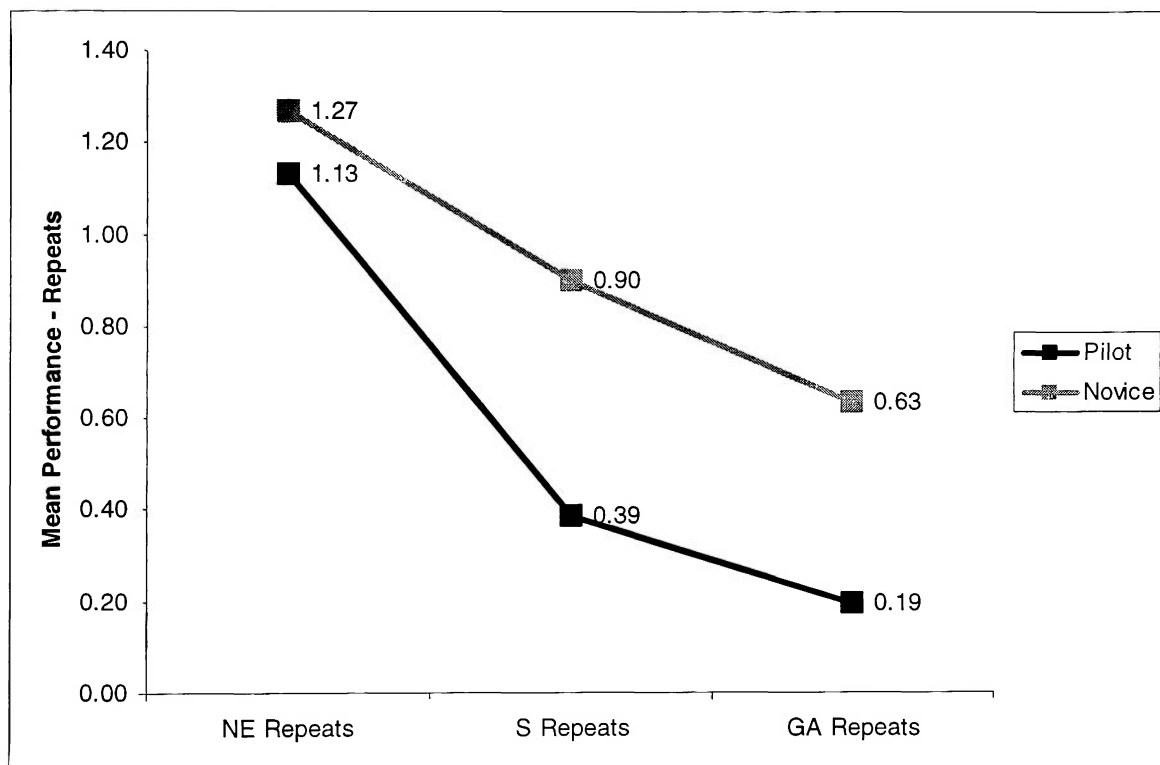


Figure 13. Effects of Experience and Regional Dialect on Repeats

There was also a significant interaction for experience and gender of the speaker for repeats $F_{(1, 59)} = 4.80, p = .03$ (See Table 21, Figure 14). There is approximately a 58% chance of finding a significant difference between experience level and gender of

speaker for repeats. Partial eta squared showed that experience and gender of speaker account for 8% of the overall variance.

Figure 14 shows the mean performance for each experience level when hearing the male and female voices. For both genders the pilot group requested fewer repeats compared to the novice group. Both, the pilot and novice groups requested more repeats when hearing the female voice compared to the male voice. These results were analyzed further with Tukey post hoc comparison $HSD (.05) = .52$. The post hoc test concluded that performance was significantly different when hearing a male and female voice for both the pilot and novice group. Therefore, regardless of experience level or regional dialect of speaker, participants performed significantly different when hearing the male voice compared to the female voice.

Table 21. Effects of Experience and Gender on Repeats

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Experience/ Gender	1	1.18	1.18	4.80	.03	.58	.08
Error	59	14.52	.25				

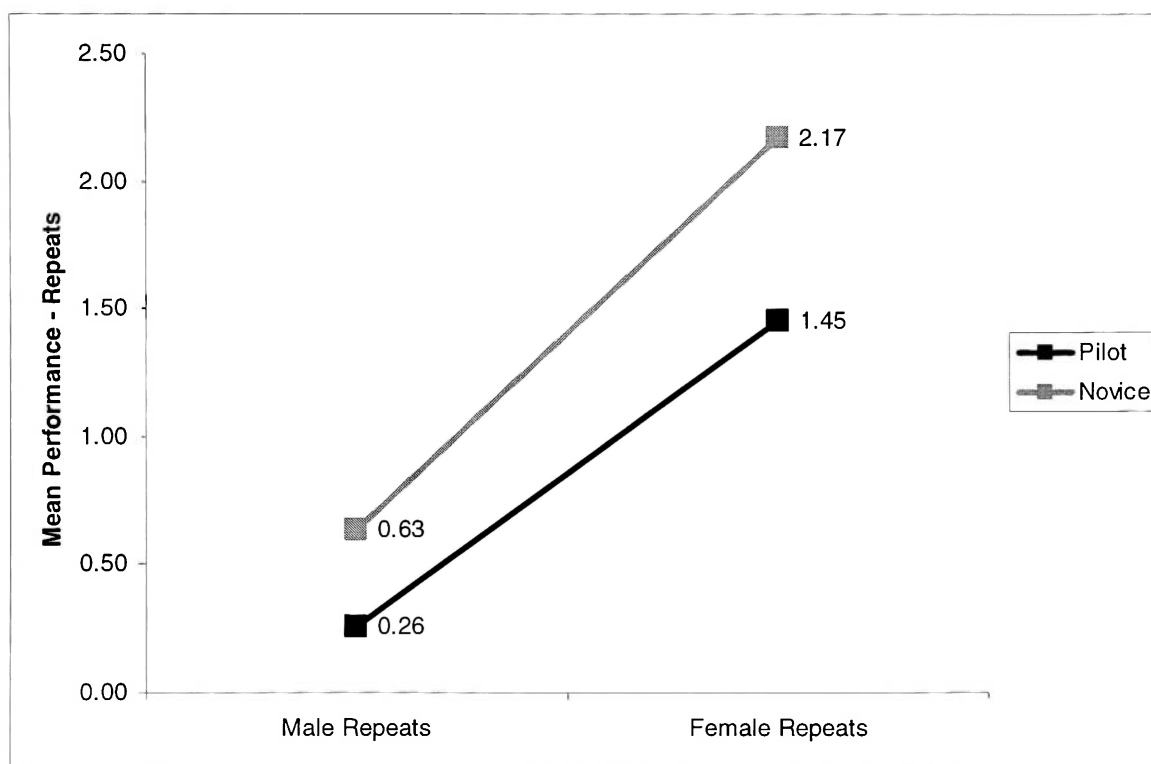


Figure 14. Effects of Experience and Gender on Repeats

There was also potential for a three way interaction for experience, regional dialect and gender of the speaker for repeats. There was no significant interaction found for flight experience and regional dialect and gender of the speaker for repeats $F_{(1, 59)} = .67, p = .42$.

Hypothesis four was supported among repeats. Specifically, performance was better among the male voice than the female voice, regardless of experience level. Also, regardless of experience level both groups performed significantly different among each regional dialect. Although it was not hypothesized, results show that the New England dialect was the most difficult to recall for both the pilot and novice groups (See Table 22).

Table 22. Experience Mean Differences for Repeats

Source		Mean	SD	N
Voice Type	Experience			
NE Male	Pilot	.16	.45	31
	Novice	.27	.52	30
	Total	.21	.49	61
S Male	Pilot	.03	.18	31
	Novice	.03	.18	30
	Total	.03	.18	61
GA Male	Pilot	.06	.36	31
	Novice	.33	.66	30
	Total	.20	.54	61
NE Female	Pilot	.97	.88	31
	Novice	1.00	1.17	30
	Total	.98	1.03	61
S Female	Pilot	.35	.55	31
	Novice	.87	1.17	30
	Total	.61	.94	61
GA Female	Pilot	.13	.34	31

Novice	.30	.65	30
Total	.21	.52	61

Effect of Gender on Performance

Hypothesis five stated that participants will perform better when hearing a male voice compared to a female voice. Specifically more errors will be made when hearing a female voice compared to a male voice. Also, more repeats will be requested when hearing a female voice compared to a male voice.

Analysis for hypothesis five stemmed from values in hypothesis one. In hypothesis one a three way mixed ANOVA design was used (birth region X speaker regional dialect X speaker gender) to analyze possible interaction effects among errors. The independent variables were participants' birth region and regional dialect and gender of the speaker. The dependent variable was errors.

A significant main effect was found for gender $F_{(1, 57)} = 28.6, p = .00$ (See Table 23, Figure 15). Partial eta squared shows that 33% of the total variance is attributed to gender. The power of this analysis was 100% for a significant difference between means for gender errors.

Figure 15 shows the mean performance when hearing a male voice and female voice. The female voice was associated with the most errors compared to the male voice. These differences were analyzed further with Tukey post hoc comparisons HSD (.05) = .36. Indeed, there were significant differences in performance when hearing a male and female voice. Specifically differences were among the New England male and New England female voices and the Southern male and Southern female voices.

Interaction effects among birth region and regional dialect of the speaker among errors are listed under hypothesis one results.

Table 23. Effect of Gender on Errors

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>P</i>	Power	n^2
Gender	1	28.27	28.27	28.63	.00	1.0	.33
Error	57	56.28	.98				

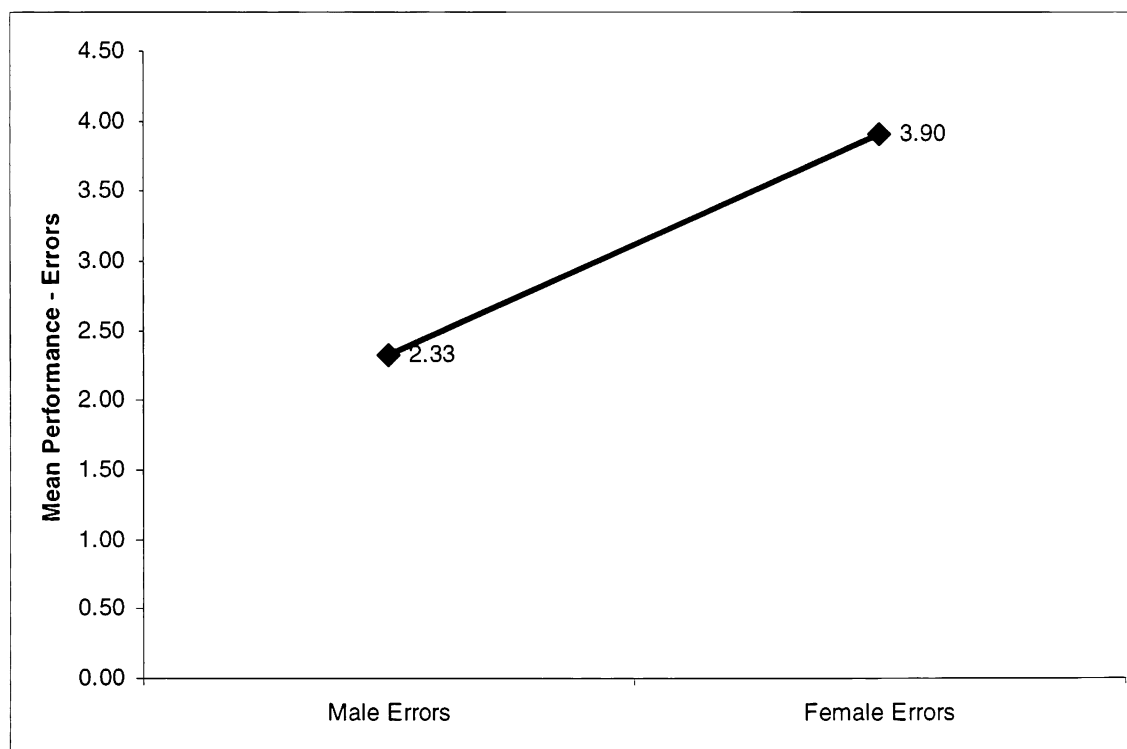


Figure 15. Effect of Gender on Errors

A three way mixed ANOVA design was used (birth region X speaker regional dialect X speaker gender) to analyze possible interaction effects among repeats. The independent variables were participants' birth region and regional dialect and gender of the speaker. The dependent variable was repeats.

There was not a significant main effect for gender $F_{(1, 57)} = 1.83, p = .18$. Interaction effects for birth region and regional dialect of the speaker among repeats is discussed in the hypothesis one results.

DISCUSSION

Previous research has demonstrated that individuals take in two levels of information in speech perception, consisting of the meaning of a word and characteristics of the speaker's voice (Goldstein, 1999). There is a complex set of norms and stereotypes associated with speaker dialects within the United States (Mulac & Rudd, 1977). Literature has shown that male voice types are associated with greater accuracy in performance when compared to female and machine voice types (Freedman, 1983). Literature has also stated that regional dialects are best understood when the dialect is familiar to the listener.

This study sought to combine these findings to determine if speaker gender does make a difference in performance. This research also explored if performance is affected when hearing various regional dialects in regards to participant familiarity and birth origin. In addition, this research explored if performance is affected by flight experience. The results of this study supported past results, with a few exceptions.

Hypothesis One

Hypothesis one stated there will be an interaction effect based on the participants' birth region and the regional dialect they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the dialect of their birth region.

This hypothesis was partially supported. Participants' birth region and the regional dialect they heard was significant among repeats. Although not hypothesized, participants' birth region and gender of the speaker was significant among errors.

Regardless of participants' birth region, performance was different when hearing the New England and Southern dialects. That is, performance was significantly different between the New England male and New England female. Also, performance was different between the Southern male and Southern female. There was not a significant difference between the General American male and General American female.

Participants born in the West, Midwest and South performed significantly different among all regional dialects spoken with a female voice. Participants from the Northeast performed very similar except for the General American female and Southern female voice. That is, there was no significant difference in performance among the General American female and Southern female voice. Participants born in the West and Northeast performed significantly different among the General American male and Southern male voice. Participants from the West also performed significantly different among the General American male and New England male voice.

The inequality of participants in each birth region could be a contributing factor to the results. For example, the majority of participants were born in the South and only 8 out of 61 participants were from the West. There were 13 participants from the Midwest and 13 from the Northeast.

Although not hypothesized, participants' birth region and the gender of speaker was found to be significant among errors. Across all the regional dialects, the male voice was associated with the least errors compared to the female voice. Although this

hypothesis was not supported for errors it was supported for repeats. It is difficult to assume that birth region influences regional dialect comprehension, at least in this study. Although not statistically significant, participants from the Northeast and South performed better when hearing the New England dialect compared to those born in the West and Midwest. Also, participants from the Northeast performed better among the Southern dialect than those from the South. This is interesting due to the geography of these regions. The close proximity of these birth regions could be a contributing factor in performance.

The only significant interaction with birth region and regional dialect was from participants from the West. Again, only 8 participants were from the West. Those from the West had significant differences in performance among the General American and New England dialect. They also had significant performance differences among the General American and Southern dialect.

Hypothesis Two

Hypothesis two stated there will be an interaction effect on participants' dialect rating and the dialect they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the dialect in which they speak. This hypothesis was supported for errors but not for repeats. Those rated as having a General American dialect performed better than those rated as "other" for all regional dialects regardless of gender of the speaker. Those rated as having a General American dialect had the fewest errors when hearing the General American dialect compared to when hearing the New England and Southern dialects. The New England dialect was

associated with the most errors regardless of gender of speaker and participants' dialect rating.

Those rated as having a General American dialect had significant differences in performance among the Southern male and Southern female. Also, those rated as General American has significant differences in performance among the New England male and Southern male but not for the New England female and Southern female. Those rated as "other" performed significantly different among all pair wise comparisons except for the General American male and New England male.

Although this hypothesis was supported it seems quite vague. It was difficult for the researcher to accurately assign a dialect to each participant throughout the testing. Therefore, the majority of participants were rated as having a General American dialect if they did not have a distinct Southern or New England dialect. As hypothesized, performance was best when the participants with a General American dialect heard the General American speaker. Also, because only two of the participants spoke with a New England dialect, it also correlates with this hypothesis due to the worst performance resulting when hearing the New England dialect.

Hypothesis Three

Hypothesis three stated that there will be a negative correlation between participants' self rated regional dialect familiarity and the regional dialect which they are exposed to. Specifically, participants will make fewer errors and need fewer repeats when hearing the regional dialect they are most familiar with. The results for this hypothesis were partially supported.

There was a significant correlation between New England dialect familiarity and New England dialect errors. There was also a significant relationship between New England dialect familiarity and General American errors. That is, the more familiarity participants had with a New England dialect, the fewer errors were made when hearing the New England dialect as well as when hearing the General American dialect. A significant relationship was also found with Southern dialect familiarity and New England dialect repeats. That is, the more familiar participants were with a Southern dialect, the fewer repeats needed when hearing the New England dialect. This makes sense due to the geography of the Southern and New England regions. New England is in close proximity with the Southern states, which help aid regional dialect familiarity.

Results showed that participants were the least familiar with the New England dialect. This is interesting because the most errors and most requested repeats were made when hearing the New England dialect. Results also showed that participants were most familiar with the General American dialect and the least amount of errors and repeats were with hearing the General American dialect.

These results coincide with the literature stating that individuals will comprehend regional dialects and foreign accents they are most familiar with more accurately than those they are not familiar with.

Hypothesis Four

Hypothesis four stated that performance will increase with flight experience. Specifically, the pilot group will make fewer errors and need fewer repeats compared to

the novice group. This hypothesis was supported for repeats and partially supported for errors.

The pilot group made more errors than the novice group. Regardless of experience, participants performed significantly different among all regional dialect comparisons spoken in a female voice. The pilot group only performed differently between the New England and General American dialects in a male voice. The novice group performed significantly different among all regional dialect comparisons for both genders except for the New England and Southern female voice.

The results confirm that performance in recall will be better when the individual is familiar with the content being spoken about. This was also clear to the researcher during testing. Some novice participants requested repeats and made errors because the content was so unfamiliar to them. Also, most participants in post task discussions seemed to have the most difficulty interpreting the New England and Southern dialects, especially with the female speaker. Therefore, trying to interpret a distinct dialect describing unfamiliar content can be quite confusing to the listener.

Although it was not hypothesized, both groups performed significantly different between the male and female voices. Specifically, more repeats were needed among the female voice than the male voice. This could be attributed to the masculine topics being spoken about or due to the fact that all participants were male.

Hypothesis Five

Hypothesis five stated that when a female voice is heard, performance will decrease. Specifically, participants will need more repeats and make more errors when

hearing a female voice compared to hearing a male voice. As with previous literature, this hypothesis was supported. Performance was best when hearing the male voice compared to the female voice. In post-task discussions, many participants expressed more difficulty in understanding the female voice especially when she was speaking with a Southern or New England dialect.

It is possible that performance was better when hearing a male voice due to all of the participants being male. Also, there was only a ten second delay between each air traffic control statement and the participants were warned of this before the test started. That is, the participants were informed they would have approximately 10 seconds to repeat the statement they heard. As previous literature was demonstrated (Freedman, 1983), accuracy to voice warning systems was best among a male voice compared to a female or machine voice. It is possible that with the time constraint on participant recall in this study, they responded faster and more accurately to the male voice when compared to the female voice.

CONCLUSIONS & RECOMMENDATIONS

The real question lies in the overall meaning of the data summarized in this study. What are the practical applications of this research within the aviation community, specifically air traffic control communication? The broad conclusion is that the impact of speaker dialect on performance is rather diverse and complex.

The results of this research are not intended to disrupt current air traffic controller's jobs or lives. They are however, intended to inform individuals within the aviation community that performance is in deed affected by the dialect of the speaker. Whether those differences are due to the phonology of the dialect, stereotypes associated with the dialect or simply personal preference of a dialect, differences in performance are apparent.

The research implies that a male voice is associated with better performance in communication situations among a male population regardless of regional dialect. It is recommended that future researchers test a female population as well. It may be that males tend to other male voices more accurately whereas females tend to other female voices more accurately. From this research it is impossible to determine if the performance differences exist as a function of gender communication style differences or gender biases as the Sapir-Whorf Hypothesis suggests. At any rate, the aviation industry

could not ethically or practically pair the male air traffic controllers with male pilots and the female controllers with female pilots.

Among regional dialect, the research implies that performance is best when the individual is familiar with the dialect. Birth region should not have an impact, however where individuals reside most of their lives and/or the dialect they speak in will have a greater impact on dialect comprehension. Therefore, it could be recommended that air traffic controllers be assigned to regions which they are most familiar or a region their dialect best represents. This could or could not be beneficial due to the diversity within the aviation industry. Even if an air traffic controller is assigned to a region that best represents their regional dialect, the pilot they are communicating with may not be from that region. There has been very minimal research to date on this topic and it may be because of the continuous cultural diversity that exists within the aviation industry. For example, a commercial pilot may reside in the Southern United States but may fly to the West coast several times in a week.

In regards to the vast amounts of errors, repeats and post-task discussions, future research should focus on the Southern and New England dialects. Is it that they are truly more difficult to comprehend when the listener does not have a distinct dialect? Or is the negative performance and negative post task remarks based on stereotypes related to these dialects? The current research may not be useful in the hiring and placement of air traffic controllers and pilots however it is still beneficial to the aviation community. Based on this research, one would probably want to use a male voice that has no distinct accent when choosing the best voice for a cockpit voice warning system. In conclusion, since listener performance is linked to speaker dialect type, any system that expects time

sensitive and/or accurate responses should focus on their audience and then in finding the most appropriate voice type.

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Appendix A
Consent Form

Voice Types in Aviation Communication

Conducted by Erin McCollum
Advisor: Dr. Christina Frederick- Recascino
Dept. of Human Factors and Systems
Embry-Riddle Aeronautical University
Daytona Beach, FL 32114

The experiment you are about to participate in is concerned with the importance of clarity within aviation communication. The purpose is to investigate recall of air traffic control statements as directed by various voice types.

There are no known risks associated with this experiment. This is a completely voluntary experiment and you may withdraw at any time. Your assistance in this experiment will help determine the best voice type to be utilized in aviation communication.

Thank you for your participation. If you have any questions, please ask during the experiment or feel free to call me at (386) 871-4588.

Statement of Consent

I acknowledge that my participation in this experiment is entirely voluntary and that I am free to withdraw at any time. I have been informed as to the general scientific purposed of the experiment.

Participant's name (please print): _____

Signature of participant: _____ Date: _____

Experimenter: _____ Date: _____

Appendix B
Demographic Questionnaire

Demographic Questionnaire

Participant Name _____

Participant Number _____

Age _____ Flight Hours _____

1. Where were you born? _____

2. List all of the places you have lived and how long.

3. How long have you lived in Daytona Beach, FL? _____

4. Do you hold a Class I & II Medical Yes No

5. Have you taken AS 130? Yes No

6. Have you taken AS 230? Yes No

7. Are you Air traffic major or minor? Yes No

Experimenters rating of participant dialect: _____

Appendix C

Experiment Instructions

Experiment Instructions

You will hear a total of sixty air traffic control statements. After each statement you will have to repeat verbatim the statement. If you need a repeat, specify out loud “say again”. (You will not get to hear the same exact line again, however it needs to be recognized if you are unable to recall the information.)

At the same time, you will also be in front of a laptop computer viewing various photographs of planes. You will need to focus on the visual presentation as much as possible during the experiment.

Appendix D
Dialect Familiarity

Name:				
Participant Number:	Very Much	Somewhat	Very Little	Not at all
1. How familiar are you with a Southern accent?				
2. How familiar are you with a New England accent?				
3. How familiar are you with a General American accent?				

Appendix E

Air Traffic Control CD's

CD 1
 48NF Turn left heading (240) two four zero
 49NF Aero Commander maintain (8,000) eight thousand hold
 36SF After takeoff turn right direct Flagler
 40SF Apache (41) four one maintain (7,000) seven thousand
 58AF Riddle (N657) November six five seven traffic
 47NF Apache (4P) four papa cleared for takeoff
 45NF ATC clears Apache (L) Lima to Oceanside
 27AM Cessna (26L) two six lima head south
 20NM Cessna (46) four six cleared to land
 26AM ATC clears Apache to Palmdale Airport
 29AM ATC clears Baron to Jacksonville Beach
 38SF ATC clears Navajo (26P) two six papa
 6SM ATC clears Riddle (910) niner one zero
 59AF Turn right, heading (160) one six zero
 4SM Turn right heading (153) one five three
 35SF ATC clears Twin Commanche (7Y) seven yankee
 50NF ATC clears Twin Navalon (91) niner one
 21AM Aztec (372P) three seven two papa cleared
 28AM Aztec (3P) three papa cleared to land
 24AM Bonanza (8D) eight delta cleared to Atlanta
 34SF Cessna (1F) one foxtrot cleared Ontario airport
 1SM Riddle (443) four four three taxi runway
 51AF Riddle (443) four four three taxi runway
 13NM Cessna (488) four eight eight contact Daytona
 9SM Turn right heading (120) one two zero
 32SF Cleared to Lake Hughes heading northeast
 7SM Climb to (3,500) three thousand five hundred
 57AF Climb to (3,500) three thousand five hundred
 31SF Commander (718C) seven one eight Charlie clear
 33SF Cross Bassett at (5,000) five thousand hold
 46NF Descend to altitude (120) one two zero
 12NM Fly heading left (180) one eight zero
 41NF Frontier (278) two seven eight turn left
 17NM Heading left (8610) eight six one zero
 42NF Turn right heading (120) one two zero
 43NF Land (6) six miles southwest of Tallahassee
 44NF Navalon turn heading (050) zero five zero
 53AF Riddle (13) one three to ILS approach
 14NM Riddle (28) two eight localize traffic inbound
 3SM Riddle (443) four four three Daytona approach
 5SM Seminole (847) eight four seven follow shoreline

55AF Seminole (84L) eight four lima follow shoreline
10SM Riddle (68) six eight frequency change approved
60AF Riddle (71) seven one frequency change approved
25AM Riddle (74) seven four maintain (3,000) three thousand
8SM Riddle (89) eight niner traffic at eleven o'clock
56AF Riddle (916) niner one six, request altitude
16NM Riddle (92) niner two cleared for approach
23AM Cessna (58) five eight maintain (6,000) six thousand
37SF Riddle descend and maintain (8,000) eight thousand
54AF Riddle maintain heading (350) three five zero
15NM Seminole (070) zero seven zero join final
19NM Seminole (7) seven heading (480) four eight zero
11NM Seminole (711) seven one one Flagler approach
22AM Heading west cleared to Los Angeles
18NM Apache (457) four seven five follow Cessna
30AM Seminole cross Barry at (7,000) seven thousand
2SM Turn left heading (530) five three zero
52AF Turn left heading (530) five three zero
39SF Turn northwest heading toward Palmdale Airport

CD 2
 59AF Turn right, heading (160) one six zero
 20NM Cessna (46) four six cleared to land
 36SF After takeoff turn right direct Flagler
 40SF Apache (41) four one maintain (7,000) seven thousand
 58AF Riddle (N657) November six five seven traffic
 47NF Apache (4P) four papa cleared for takeoff
 45NF ATC clears Apache (L) Lima to Oceanside
 27AM Cessna (26L) two six lima head south
 43NF Land (6) six miles southwest of Tallahassee
 26AM ATC clears Apache to Palmdale Airport
 30AM Seminole cross Barry at (7,000) seven thousand
 2SM Turn left heading (530) five three zero
 29AM ATC clears Baron to Jacksonville Beach
 38SF ATC clears Navajo (26P) two six papa
 6SM ATC clears Riddle (910) niner one zero
 19NM Seminole (7) seven heading (480) four eight zero
 4SM Turn right heading (153) one five three
 35SF ATC clears Twin Commanche (7Y) seven yankee
 50NF ATC clears Twin Navalon (91) niner one
 21AM Aztec (372P) three seven two papa cleared
 28AM Aztec (3P) three papa cleared to land
 24AM Bonanza (8D) eight delta cleared to Atlanta
 34SF Cessna (1F) one foxtrot cleared Ontario airport
 1SM Riddle (443) four four three taxi runway
 51AF Riddle (443) four four three taxi runway
 13NM Cessna (488) four eight eight contact Daytona
 9SM Turn right heading (120) one two zero
 32SF Cleared to Lake Hughes heading northeast
 7SM Climb to (3,500) three thousand five hundred
 57AF Climb to (3,500) three thousand five hundred
 31SF Commander (718C) seven one eight Charlie clear
 33SF Cross Bassett at (5,000) five thousand hold
 46NF Descend to altitude (120) one two zero
 12NM Fly heading left (180) one eight zero
 41NF Frontier (278) two seven eight turn left
 17NM Heading left (8610) eight six one zero
 18NM Apache (457) four seven five follow Cessna
 39SF Turn northwest heading toward Palmdale Airport
 44NF Navalon turn heading (050) zero five zero
 53AF Riddle (13) one three to ILS approach
 14NM Riddle (28) two eight localize traffic inbound

3SM Riddle (443) four four three Daytona approach
5SM Seminole (847) eight four seven follow shoreline
55AF Seminole (84L) eight four lima follow shoreline
10SM Riddle (68) six eight frequency change approved
48NF Turn left heading (240) two four zero
49NF Aero Commander maintain (8,000) eight thousand hold
60AF Riddle (71) seven one frequency change approved
25AM Riddle (74) seven four maintain (3,000) three thousand
8SM Riddle (89) eight niner traffic at eleven o'clock
42NF Turn right heading (120) one two zero
56AF Riddle (916) niner one six, request altitude
16NM Riddle (92) niner two cleared for approach
23AM Cessna (58) five eight maintain (6,000) six thousand
37SF Riddle descend and maintain (8,000) eight thousand
54AF Riddle maintain heading (350) three five zero
15NM Seminole (070) zero seven zero join final
52AF Turn left heading (530) five three zero
11NM Seminole (711) seven one one Flagler approach
22AM Heading west cleared to Los Angeles

CD 3

59AF Turn right, heading (160) one six zero
 4SM Turn right heading (153) one five three
 12NM Fly heading left (180) one eight zero
 58AF Riddle (N657) November six five seven traffic
 9SM Turn right heading (120) one two zero
 42NF Turn right heading (120) one two zero
 39SF Turn northwest heading toward Palmdale Airport
 2SM Turn left heading (530) five three zero
 19NM Seminole (7) seven heading (480) four eight zero
 15NM Seminole (070) zero seven zero join final
 52AF Turn left heading (530) five three zero
 30AM Seminole cross Barry at (7,000) seven thousand
 55AF Seminole (84L) eight four lima follow shoreline
 48NF Turn left heading (240) two four zero
 11NM Seminole (711) seven one one Flagler approach
 18NM Apache (457) four seven five follow Cessna
 40SF Apache (41) four one maintain (7,000) seven thousand
 54AF Riddle maintain heading (350) three five zero
 37SF Riddle descend and maintain (8,000) eight thousand
 5SM Seminole (847) eight four seven follow shoreline
 16NM Riddle (92) niner two cleared for approach
 56AF Riddle (916) niner one six, request altitude
 8SM Riddle (89) eight niner traffic at eleven o'clock
 23AM Cessna (58) five eight maintain (6,000) six thousand
 50NF ATC clears Twin Navalon (91) niner one
 22AM Heading west cleared to Los Angeles
 25AM Riddle (74) seven four maintain (3,000) three thousand
 60AF Riddle (71) seven one frequency change approved
 10SM Riddle (68) six eight frequency change approved
 1SM Riddle (443) four four three taxi runway
 51AF Riddle (443) four four three taxi runway
 3SM Riddle (443) four four three Daytona approach
 14NM Riddle (28) two eight localize traffic inbound
 53AF Riddle (13) one three to ILS approach
 44NF Navalon turn heading (050) zero five zero
 43NF Land (6) six miles southwest of Tallahassee
 45NF ATC clears Apache (L) Lima to Oceanside
 17NM heading left (8610) eight six one zero
 41NF Frontier (278) two seven eight turn left
 34SF Cessna (1F) one foxtrot cleared Ontario airport
 46NF Descend to altitude (120) one two zero

33SF Cross Bassett at (5,000) five thousand hold
31SF Commander (718C) seven one eight Charlie clear
7SM Climb to (3,500) three thousand five hundred
57AF Climb to (3,500) three thousand five hundred
32SF Cleared to Lake Hughes heading northeast
38SF ATC clears Navajo (26P) two six papa
13NM Cessna (488) four eight eight contact Daytona
20NM Cessna (46) four six cleared to land
27AM Cessna (26L) two six lima head south
49NF Aero Commander maintain (8,000) eight thousand hold
24AM Bonanza (8D) eight delta cleared to Atlanta
28AM Aztec (3P) three papa cleared to land
21AM Aztec (372P) three seven two papa cleared
36SF After takeoff turn right direct Flagler
35SF ATC clears Twin Commanche (7Y) seven yankee
6SM ATC clears Riddle (910) niner one zero
47NF Apache (4P) four papa cleared for takeoff
29AM ATC clears Baron to Jacksonville Beach
26AM ATC clears Apache to Palmdale Airport

CD 4

11NM Seminole (711) seven one one Flagler approach
 18NM Apache (457) four seven five follow Cessna
 40SF Apache (41) four one maintain (7,000) seven thousand
 54AF Riddle maintain heading (350) three five zero
 19NM Seminole (7) seven heading (480) four eight zero
 59AF Turn right, heading (160) one six zero
 4SM Turn right heading (153) one five three
 12NM Fly heading left (180) one eight zero
 58AF Riddle (N657) November six five seven traffic
 9SM Turn right heading (120) one two zero
 42NF Turn right heading (120) one two zero
 39SF Turn northwest heading toward Palmdale Airport
 2SM Turn left heading (530) five three zero
 26AM ATC clears Apache to Palmdale Airport
 15NM Seminole (070) zero seven zero join final
 52AF Turn left heading (530) five three zero
 30AM Seminole cross Barry at (7,000) seven thousand
 55AF Seminole (84L) eight four lima follow shoreline
 48NF Turn left heading (240) two four zero
 13NM Cessna (488) four eight eight contact Daytona
 20NM Cessna (46) four six cleared to land
 1SM Riddle (443) four four three taxi runway
 56AF Riddle (916) niner one six, request altitude
 37SF Riddle descend and maintain (8,000) eight thousand
 5SM Seminole (847) eight four seven follow shoreline
 16NM Riddle (92) niner two cleared for approach
 34SF Cessna (1F) one foxtrot cleared Ontario airport
 8SM Riddle (89) eight niner traffic at eleven o'clock
 23AM Cessna (58) five eight maintain (6,000) six thousand
 50NF ATC clears Twin Navalon (91) niner one
 22AM Heading west cleared to Los Angeles
 25AM Riddle (74) seven four maintain (3,000) three thousand
 47NF Apache (4P) four papa cleared for takeoff
 10SM Riddle (68) six eight frequency change approved
 43NF Land (6) six miles southwest of Tallahassee
 51AF Riddle (443) four four three taxi runway
 3SM Riddle (443) four four three Daytona approach
 35SF ATC clears Twin Commanche (7Y) seven yankee
 53AF Riddle (13) one three to ILS approach
 44NF Navalon turn heading (050) zero five zero
 29AM ATC clears Baron to Jacksonville Beach

45NF ATC clears Apache (L) Lima to Oceanside
17NM Heading left (8610) eight six one zero
41NF Frontier (278) two seven eight turn left
60AF Riddle (71) seven one frequency change approved
46NF Descend to altitude (120) one two zero
33SF Cross Bassett at (5,000) five thousand hold
31SF Commander (718C) seven one eight Charlie clear
7SM Climb to (3,500) three thousand five hundred
57AF Climb to (3,500) three thousand five hundred
32SF Cleared to Lake Hughes heading northeast
38SF ATC clears Navajo (26P) two six papa
6SM ATC clears Riddle (910) niner one zero
14NM Riddle (28) two eight localize traffic inbound
27AM Cessna (26L) two six lima head south
49NF Aero Commander maintain (8,000) eight thousand hold
24AM Bonanza (8D) eight delta cleared to Atlanta
28AM Aztec (3P) three papa cleared to land
21AM Aztec (372P) three seven two papa cleared
36SF After takeoff turn right direct Flagler

CD 5

7SM Climb to (3,500) three thousand five hundred
 13NM Cessna (488) four eight eight contact Daytona
 4SM Turn right heading (153) one five three
 1SM Riddle (443) four four three taxi runway
 19NM Seminole (7) seven heading (480) four eight zero
 59AF Turn right, heading (160) one six zero
 26AM ATC clears Apache to Palmdale Airport
 12NM Fly heading left (180) one eight zero
 58AF Riddle (N657) November six five seven traffic
 9SM Turn right heading (120) one two zero
 42NF Turn right heading (120) one two zero
 39SF Turn northwest heading toward Palmdale Airport
 2SM Turn left heading (530) five three zero
 40SF Apache (41) four one maintain (7,000) seven thousand
 15NM Seminole (070) zero seven zero join final
 52AF Turn left heading (530) five three zero
 30AM Seminole cross Barry at (7,000) seven thousand
 55AF Seminole (84L) eight four lima follow shoreline
 48NF Turn left heading (240) two four zero
 51AF Riddle (443) four four three taxi runway
 20NM Cessna (46) four six cleared to land
 5SM Seminole (847) eight four seven follow shoreline
 56AF Riddle (916) niner one six, request altitude
 37SF Riddle descend and maintain (8,000) eight thousand
 38SF ATC clears Navajo (26P) two six papa
 16NM Riddle (92) niner two cleared for approach
 34SF Cessna (1F) one foxtrot cleared Ontario airport
 8SM Riddle (89) eight niner traffic at eleven o'clock
 23AM Cessna (58) five eight maintain (6,000) six thousand
 50NF ATC clears Twin Navalon (91) niner one
 22AM Heading west cleared to Los Angeles
 25AM Riddle (74) seven four maintain (3,000) three thousand
 47NF Apache (4P) four papa cleared for takeoff
 10SM Riddle (68) six eight frequency change approved
 43NF Land (6) six miles southwest of Tallahassee
 18NM Apache (457) four seven five follow Cessna
 3SM Riddle (443) four four three Daytona approach
 35SF ATC clears Twin Commanche (7Y) seven yankee
 53AF Riddle (13) one three to ILS approach
 44NF Navalon turn heading (050) zero five zero
 29AM ATC clears Baron to Jacksonville Beach

45NF ATC clears Apache (L) Lima to Oceanside
17NM Heading left (8610) eight six one zero
41NF Frontier (278) two seven eight turn left
60AF Riddle (71) seven one frequency change approved
46NF Descend to altitude (120) one two zero
33SF Cross Bassett at (5,000) five thousand hold
31SF Commander (718C) seven one eight Charlie clear
24AM Bonanza (8D) eight delta cleared to Atlanta
57AF Climb to (3,500) three thousand five hundred
32SF Cleared to Lake Hughes heading northeast
11NM Seminole (711) seven one one Flagler approach
6SM ATC clears Riddle (910) niner one zero
14NM Riddle (28) two eight localize traffic inbound
27AM Cessna (26L) two six lima head south
49NF Aero Commander maintain (8,000) eight thousand hold
54AF Riddle maintain heading (350) three five zero
28AM Aztec (3P) three papa cleared to land
21AM Aztec (372P) three seven two papa cleared
36SF After takeoff turn right direct Flagler

CD 6
 34SF Cessna (1F) one foxtrot cleared Ontario airport
 8SM Riddle (89) eight niner traffic at eleven o'clock
 11NM Seminole (711) seven one one Flagler approach
 28AM Aztec (3P) three papa cleared to land
 19NM Seminole (7) seven heading (480) four eight zero
 59AF Turn right, heading (160) one six zero
 26AM ATC clears Apache to Palmdale Airport
 12NM Fly heading left (180) one eight zero
 58AF Riddle (N657) November six five seven traffic
 9SM Turn right heading (120) one two zero
 42NF Turn right heading (120) one two zero
 39SF Turn northwest heading toward Palmdale Airport
 2SM Turn left heading (530) five three zero
 40SF Apache (41) four one maintain (7,000) seven thousand
 15NM Seminole (070) zero seven zero join final
 7SM Climb to (3,500) three thousand five hundred
 13NM Cessna (488) four eight eight contact Daytona
 52AF Turn left heading (530) five three zero
 30AM Seminole cross Barry at (7,000) seven thousand
 55AF Seminole (84L) eight four lima follow shoreline
 48NF Turn left heading (240) two four zero
 51AF Riddle (443) four four three taxi runway
 20NM Cessna (46) four six cleared to land
 5SM Seminole (847) eight four seven follow shoreline
 56AF Riddle (916) niner one six, request altitude
 37SF Riddle descend and maintain (8,000) eight thousand
 31SF Commander (718C) seven one eight Charlie clear
 38SF ATC clears Navajo (26P) two six papa
 16NM Riddle (92) niner two cleared for approach
 36SF After takeoff turn right direct Flagler
 1SM Riddle (443) four four three taxi runway
 23AM Cessna (58) five eight maintain (6,000) six thousand
 50NF ATC clears Twin Navalon (91) niner one
 22AM Heading west cleared to Los Angeles
 4SM Turn right heading (153) one five three
 25AM Riddle (74) seven four maintain (3,000) three thousand
 47NF Apache (4P) four papa cleared for takeoff
 10SM Riddle (68) six eight frequency change approved
 43NF Land (6) six miles southwest of Tallahassee
 18NM Apache (457) four seven five follow Cessna
 3SM Riddle (443) four four three Daytona approach

35SF ATC clears Twin Commanche (7Y) seven yankee
53AF Riddle (13) one three to ILS approach
44NF Navalon turn heading (050) zero five zero
29AM ATC clears Baron to Jacksonville Beach
45NF ATC clears Apache (L) Lima to Oceanside
17NM Heading left (8610) eight six one zero
41NF Frontier (278) two seven eight turn left
60AF Riddle (71) seven one frequency change approved
46NF Descend to altitude (120) one two zero
33SF Cross Bassett at (5,000) five thousand hold
54AF Riddle maintain heading (350) three five zero
24AM Bonanza (8D) eight delta cleared to Atlanta
57AF Climb to (3,500) three thousand five hundred
32SF Cleared to Lake Hughes heading northeast
21AM Aztec (372P) three seven two papa cleared
6SM ATC clears Riddle (910) niner one zero
14NM Riddle (28) two eight localize traffic inbound
27AM Cessna (26L) two six lima head south
49NF Aero Commander maintain (8,000) eight thousand hold